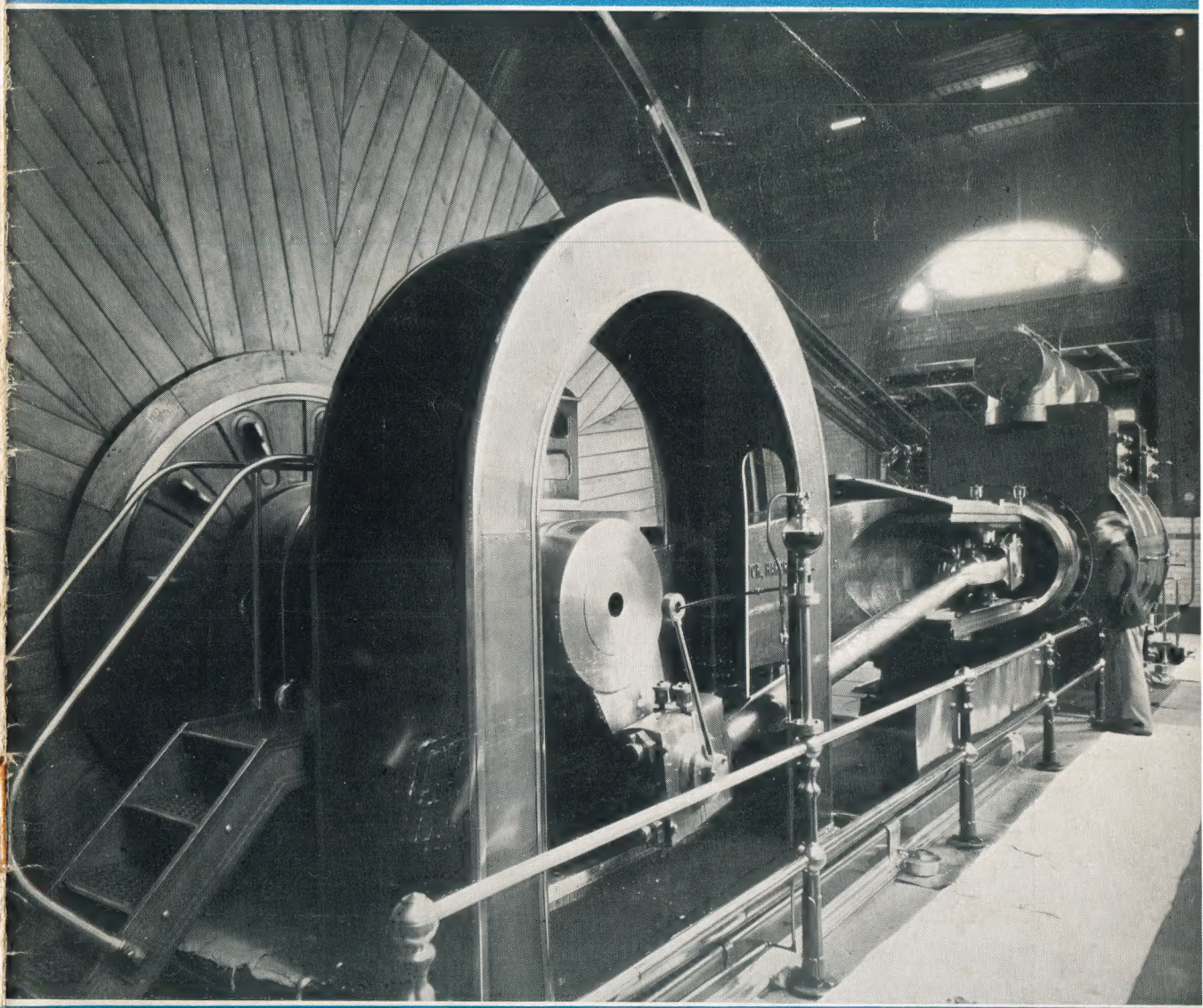
# THE MODEL ENGINEER



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MARCH 31st 1955

Vol. 112 No. 2810


9D

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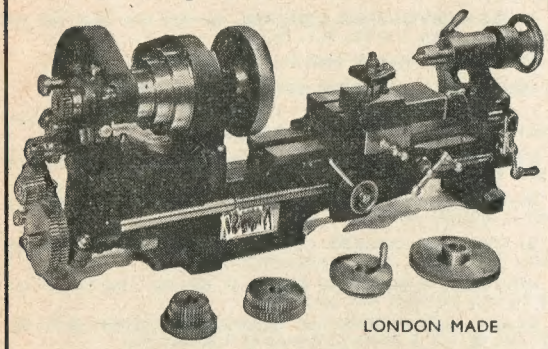

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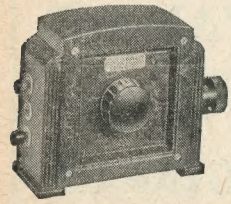

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THE
# MODEL ENGINEER

ESTABLISHED 1898

Volume 112 - No. 2810
MARCH 31st - 1955



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### OUR COVER PICTURE

Perfect proportion was usually the outstanding characteristic of old-time steam engines, no matter what size the engines were. The one seen on our cover is an excellent example of what we mean, and was one of a pair briefly described, with further photographs, by Mr. W. Watson in this issue.

# SMOKE RINGS

**Beech Hurst Opening**

THE SUSSEX Miniature Locomotive Society has decided to reopen its fine track at Beech Hurst, Haywards Heath, on Easter Saturday, April 9th, when friends from any other club will be warmly welcomed. It is hoped to arrange for locomotive running to take place every week-end during the coming season, and the society will be only too pleased to hear from anyone, especially clubs, who would like to run locomotives on the track. Such visitors are requested to get in touch with Mr. S. R. Bostel, 8, Cranbourne Street, Brighton 1, as soon as possible, so that the programme can be compiled and the local Council notified.

**Calling Owners of Unusual Boats**

THE INTEREST of those visitors to the "M.E." Exhibition who are regarded as the "general public" is always immediately attracted by the type of exhibit that is "different," or "unusual." Most of the items of this nature seem to have been forthcoming in the ship section in the past; the mechanical row-boat and the radio-controlled naval launch may be mentioned as two outstanding examples of the sort of thing referred to, but almost any model that can be made to work realistically on the water would come under this heading.

The owners of any models that can be made to give a realistic and, if possible, amusing performance within the limits of the 25 ft. square demonstration tank are requested to communicate, as soon as possible, with the Exhibition Manager, 19-20, Noel Street, London, W.1, giving full particulars of the models and their performances.

**What's in a Name ?**

IN A footnote to a letter dealing with the subject of lathe operation, a reader informs us that skilled turners very much resent being called "operators." While we do not think this was intended to raise very serious issues, it makes us wonder just how far the prevalent policy of euphemism must be carried to avoid the implication of disrespect to the persons concerned. The old terms which have served for untold years are now considered ignominious; a ratcatcher must be called a "rodent officer," a dustman a "sanitary operative," and a charwoman a "domestic assistant." We hold the view that no useful purpose is served by high-sounding titles unless they fill a gap in definite or precise terminology, which does not appear to be so in the above cases. Whether a man is called a turner, a machinist, or a lathe operator, it makes no difference to his social status or his pay packet—the important thing is that he should know his job. Personally, we do not care one iota whether we are called editors or blue-pencil propellers, so long as either term is used without malice. And now please excuse us while we lay down our "indigo-coloured writing implement" and leave the precincts of this office building to partake of "nutritional intake." !

**Appleford Traction Engine Rally**

THIS WILL be held as previously at Bridge Farm, Appleford, near Abingdon, Berks, on Saturday, June 11th. This year there will be a considerably enlarged programme and a far greater number of spectators is expected to see flat races, steam polo, relay race, tilting, and many other events.

The rally is being organised by the National Traction Engine Club, and entry forms have been sent to all members of this club, but anyone wishing to enter a steam engine for this rally should communicate with the secretary, F. Stephens, as soon as possible, at 52, Bedford Row, London, W.C.1.

Members of the National Traction Engine Club will have special privileges in entry prizes and also a Members' Tent, where it is hoped refreshments will be provided. Another new feature this year is that a greater part will be played by model engines than before. It is anticipated that a separate marquee will be put aside for anyone wishing to display models, and anybody interested in bringing models to this rally should also contact the secretary. Proceeds will be devoted to the Corneo Plastic Unit and National Eye Bank at East Grinstead.

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Telephone: GERrard 8811 Annual Subscription £2.2s.0d. post paid. (U.S.A. and Canada $6)

# Talking about Steam—

**No. 29.—THE EVOLUTION OF THE PORTABLE ENGINE**

**By W. J. HUGHES**

THE title of the present article is borrowed from one in *Feilden's Magazine* for June, 1900, the original being written by William Fletcher, M.I.Mech.E., who may well be termed the doyen of designers of traction and portable engines. He acted at some time as designer and draughtsman for several of the leading firms, including Ransomes, Sims, and Jefferies, Clayton and Shuttleworth, and Marshall; and his influence was very great in this sphere. He was also a prolific writer, with dozens of articles and at least three books to his credit.

My own article will contain quite a few illustrations and facts culled from the original, but I shall include other material from other sources, too, to make a broader and more up-to-date picture.

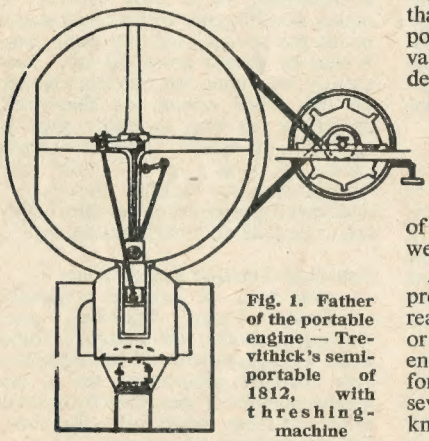


**Fig. 1. Father of the portable engine — Trevithick's semi-portable of 1812, with threshing-machine**

### The Ubiquitous Portable Engine

In 1900, it was undoubtedly true that, as Fletcher wrote, the unassuming portable engine was one of the most valuable drudges that science had ever devised for the good of mankind. Myriads of them were subject to rough treatment by their owners, with dirty feedwater and rare boiler cleaning, exposure to the weather, little attention to lubrication, and brasses allowed to knock for want of adjustment. In spite of all this, they worked regularly and well.

At the same time, many engines were properly looked after, and their owners reaped the benefit, in long life and few or even no replacements of parts. Such engines worked often for periods of forty or fifty years, and indeed cases of seventy years' working life have been known. Hundreds of thousands of portables were built—one firm alone had built more than 33,000 in 1900—and many of these were exported, to work in swamp, forest, jungle, or other primitive places. There are even a few being built today !

Trevithick may well be said to be the father of the portable engine, for it was not until the use of high-pressure steam came in that engines could be built small and light enough. In 1812, he made an engine for Sir Charles Hawkins which may be termed a semi-portable; this is depicted in Fig. 1, which shows the cylinder to be embedded in a plain boiler, driving the crank placed vertically overhead. A small threshing machine is belt-driven from the flywheel.

The dimensions of the engine are not known, unfortunately, but in 1812, Trevithick wrote to Sir John Sinclair that he was building one about two-thirds the size of the Hawkins engine. This was to be "portable on wheels," and moved from place to place "as easily as a one-horse cart. . . . The steam can be raised, and the engine moved a distance of two miles, and the threshing-machine at work within an hour. The weight, including engine, carriage, and wheels, will not exceed 15 cwt." Obviously, this was a true portable engine.

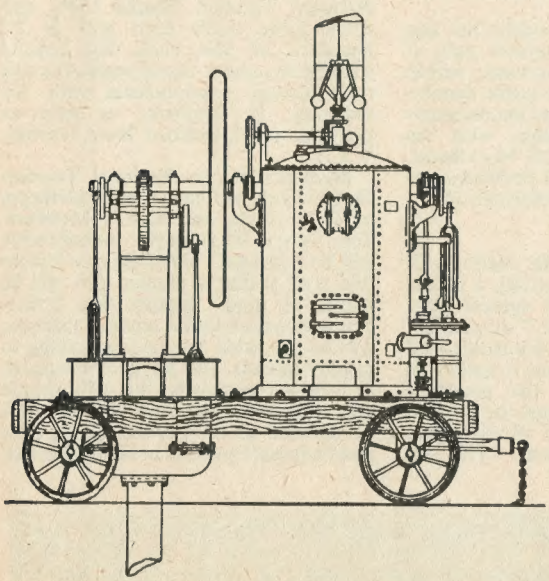


**Fig. 2. Gough's portable pumping-engine, built in 1830**

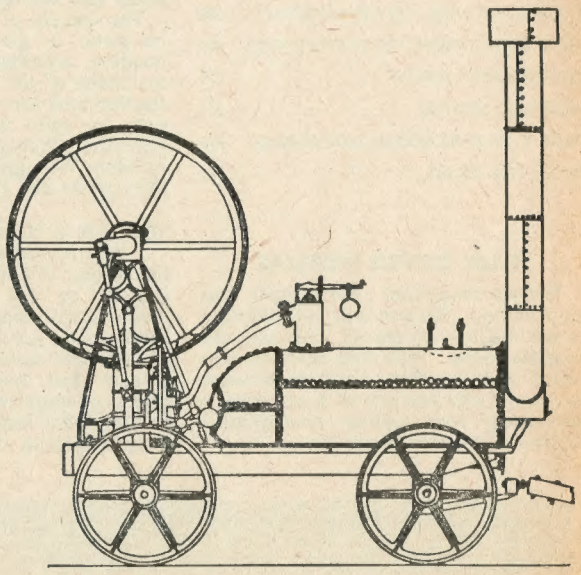


**Fig. 3. Howden's six horse-power engine, with return-flue boiler**

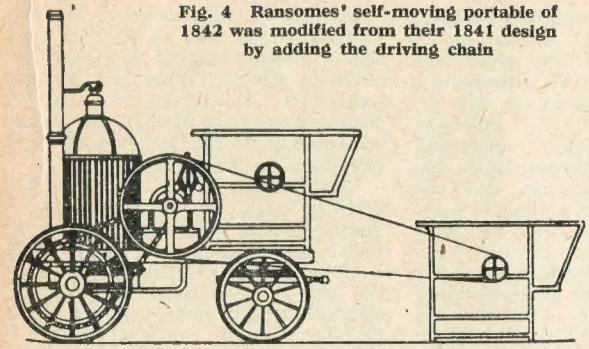


Fig. 4 Ransomes' self-moving portable of 1842 was modified from their 1841 design by adding the driving chain

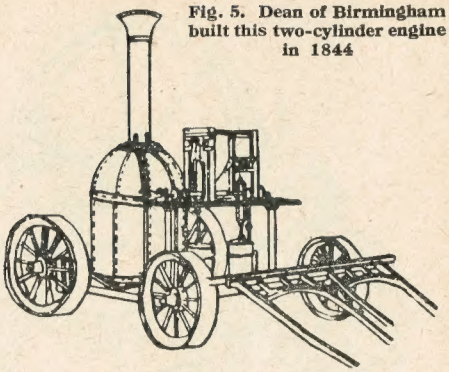


Fig. 5. Dean of Birmingham built this two-cylinder engine in 1844

It is also on record that, in 1805, a portable built by Trevithick was in use at the Weath Mine. "The facility of manufacturing and cheapness of the engines caused them to be much used." These engines were of a similar design, it is believed, to the one which is in the Science Museum, but mounted on a carriage.

**A Northern Manufacturer**

In 1830, Nathan Gough of Salford began to manufacture portable and also "self-moving" engines. One of the former, with two gear-driven pumps for raising water mounted on the same wooden frame, is shown in Fig. 2, with a vertical boiler and inverted vertical engine. The connecting-rod is of the hairpin type, with a guide-rod supported by a bracket fixed to the boiler, and the crankshaft, which evidently passes through the boiler, runs in bearing-brackets also similarly fixed. Similar engines, but without the pumps, were supplied for agricultural purposes.

Incidentally, Gough was the first person I have been able to trace who used, in his steam-carriage, the bevel type of differential gear that many people think is a comparatively modern invention for the motor-car.

A Boston man, James(?) Howden, exhibited a 6 h.p. portable (Fig. 3) at the 1839 show of the Lincolnshire Agricultural Society. This had a return-flue boiler, with a vertical inverted engine whose crankshaft was carried in A-frames. However, after building twelve of these engines, Howden ceased production, as he "feared the country would become over-stocked with portable engines." To use a modern phrase, he certainly missed the bus !

**A Self-moving Engine**

One of the first, if not *the* first, self-moving agricultural engines (as opposed to steam-carriages), was that built by Ransomes, Sims and Head in 1842, shown in Fig. 4. This had a rotary or disc type of engine, which could be connected to the hind wheel by chain-drive, and horse-steerage. The platform was large enough to carry a threshing-machine, which, when required for use, was dismounted as shown.

Alexander Dean of Birmingham, had built a single-cylinder engine in 1839, and his two-cylinder portable of 1844 is seen in the next picture. Detail is a little obscure, but the cylinders drive upwards, with return-connecting-rods to the crankshaft. No flywheel is shown, but the left-hand end of the shaft is fitted with one fork of a universal joint, through which machinery could be driven.

Another firm who mounted the threshing machine on the frame of the engine, was Tuxford's of Boston, in 1842. Seen in Fig. 6, this design had an oscillating-cylinder, with the crankshaft driving a right-angle shaft by bevel-gearing. The boiler was of the return-flue type,

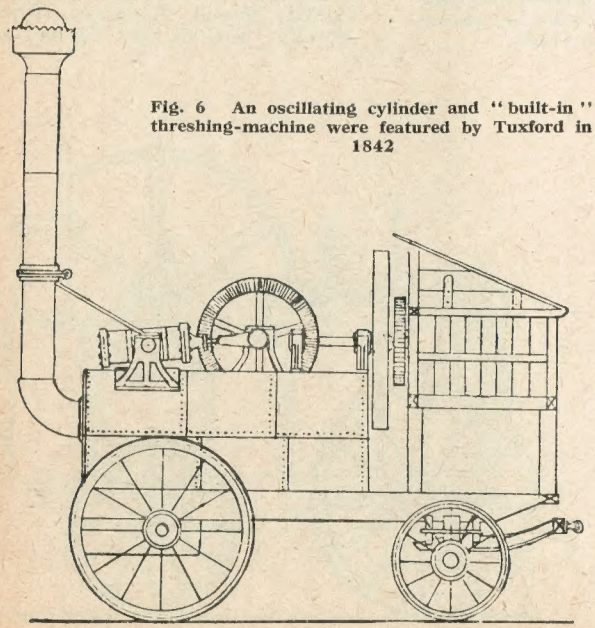
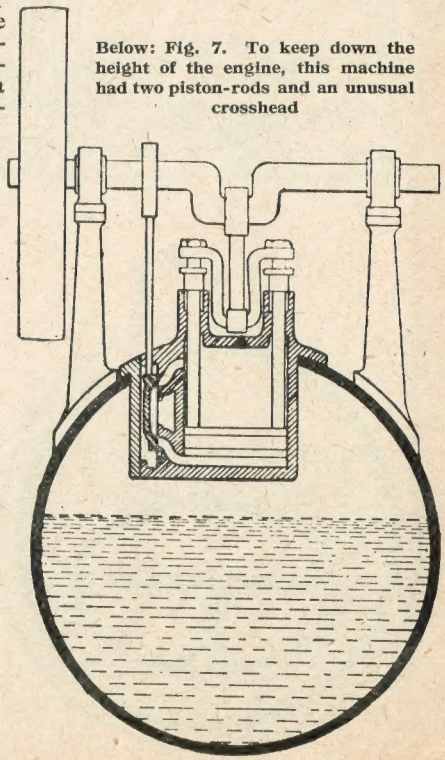


Fig. 6 An oscillating cylinder and "built-in" threshing-machine were featured by Tuxford in 1842

Below: Fig. 7. To keep down the height of the engine, this machine had two piston-rods and an unusual crosshead



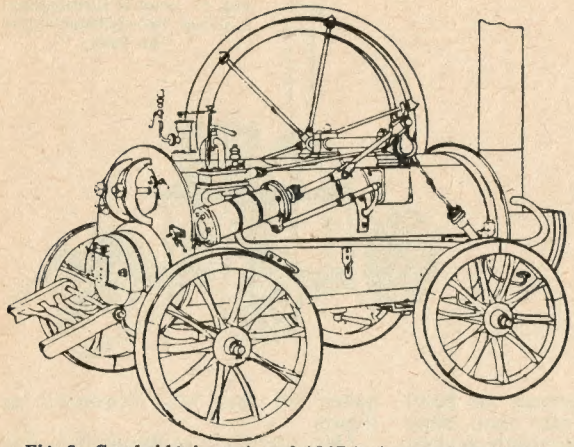


Fig. 8. Cambridge's engine of 1847 had several unusual points of design (see text)

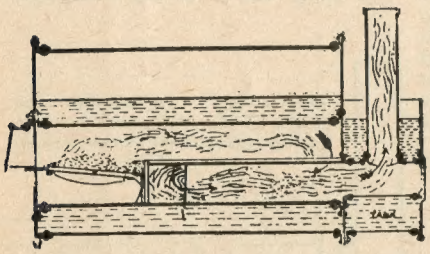
which Tuxfords adhered to for many years.

**Unusual Boiler Design**

A Mr. Cambridge of Market Lavington was building portables in 1842, with a vertical cylinder immersed in the boiler top (Fig. 7). Notice the twin piston-rods, peculiar cross-head, and recessed cylinder-end necessitated by the design.

Fletcher says that Cambridge built a large number of engines, but scarcely two alike. By 1847, the vertical cylinder had given way to the arrangement shown in Fig. 8, which possesses many interesting features. Note, for instance, that the valve-chest is separate from the cylinder, and only connected with it by the steam-passages. The cross-head is guided by a single bar, and the flywheel has cast boss and rim, with wrought-iron spokes.

Perhaps the boiler is the most interesting feature, however. The flat ends are secured to the shell by angle-rings, and an oval flue passes between the ends. From the fire, the hot gases pass forward, then back more than half-way through the left-hand lower passage, then forwards again to the base of the chimney and out. The lower part of the chimney is enclosed in an open water-tank, from which the feed-pump draws its now heated supply.



Left: Fig. 9. Longitudinal and cross sections of Cambridge's boiler

The engine was mounted on four wooden wheels, and, as Fletcher says, was a distinct advance in design, resembling engines of a later date in many particulars. It won an award at the Northampton show of 1847, and several engines built to the design worked for over half-a-century thereafter.

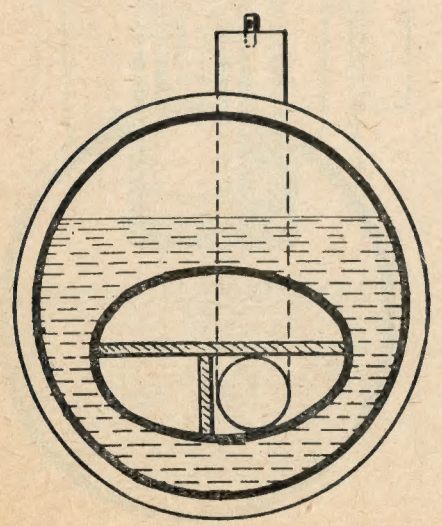
Clayton and Shuttleworth started building portables in 1846, with a double-cylinder engine on top of the boiler, and a crankshaft which drove a separate flywheel shaft through gearing with a 3-to-1 ratio. In 1849, this arrangement had given way to a single-cylinder with an overhung crank, as shown in Fig. 17 (next article). The pump was mounted on the side of the cylinder, and driven from the cross-head. Apart from the overhung crank, the engine greatly resembled that shown in Fig. 10, which has a bent crank, and is dated 1853.

Hornsby and Sons built their first portable in 1847, and in 1848 one of their engines was awarded a prize of £50 at the Royal Show at York. This engine had a round firebox with a domed top, as shown in Fig. 11; and it is interesting to note that a similar type of stayless firebox was used, nearly 80 years after the Hornsby design, by Robey's in their steam wagons and tandem rollers.

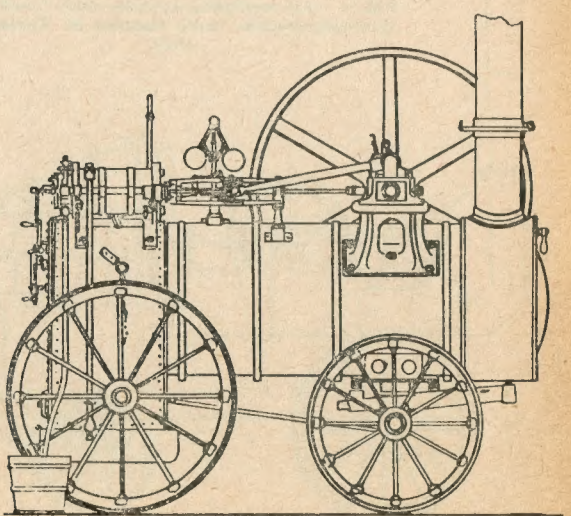
It will be seen that instead of a conventional water-gauge, three cocks were fitted to indicate high, medium, and low water-levels, respectively, on this portable. Unusual features are the crank, machined all over, and the screw-down type of regulator valve.

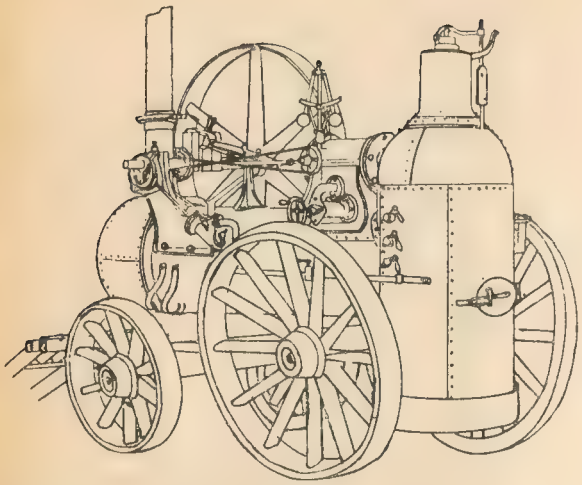
**The Great Exhibition**

By the time of the Great Exhibition of 1851, portable engines were being built in large numbers by many different makers. Several of these, including the Garrett, Burrell, Ransomes, Turner, Hornsby, Tuxford, and Clayton and



Below: Fig. 10. Clayton and Shuttleworth's portable of 1852 had a lagged boiler and was on iron wheels





Left: Fig. 11 Hornsby's 1849 engine had a circular stayless firebox

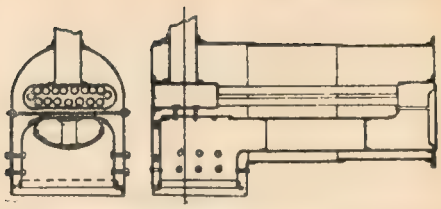


Fig. 12. Sections through Tuxford's return-flue boiler of 1851

Shuttleworth, were illustrated in THE MODEL ENGINEER, dated May 10th, 1951, and described by "The Dominie" in his series of articles entitled "That Wonderful Year . . ." and it is not proposed to say more about them here. However, the two further illustrations of the Tuxford engine now given will be of interest, I think, especially to anyone contemplating building a model. (And it would be a most interesting and unusual model, too !)

Fig. 12 shows sections through the boiler, which is of the return-tube type. An oval flue, with two plate-type stays, leads forwards from the firebox to a chamber, from which seventeen flue-tubes lead back to the oval smokebox. This is entirely contained in the water-space; its upper surface is stayed by the chimney, and its lower one to the firebox top.

The engine, shown in Fig. 13, is totally enclosed in a sheet-iron casing, and is similar in design to the Tuxford engine, shown in "The Dominie's" article dated August 2nd, 1951. The cylinder is vertical, with the piston driving a crosshead above it. From the ends of this crosshead, two rods are connected to crossheads sliding in guides at either side of the cylinder, from which two connecting-rods return the motion to the crankshaft. The valve is driven from a rocking-shaft, on the flywheel end of which is an arm connected to the eccentric-rod. A link connected to this rod also drives the water-pump, which is vertically below it.

I agree that a *true-scale* model of this portable could not be built from the available information, but by carefully measuring-up and studying the four illustrations—there is a further perspective view in the 1951 article—it would be possible to produce a model to satisfy all but the most finicky. And even they would find it difficult to justify criticism, if the workmanship was up to standard !

**Steam-jacketed Cylinder**

Hornsby's engine of 1851, it may be recalled, had the cylinder steam-jacketed by enclosing it in an upward extension of the firebox. This idea was carried a stage further by Clayton & Shuttleworth in 1853, who used a cast steam-jacket on the cylinder itself, and then enclosed the whole thing in the smokebox, to keep the jacket warm. Fig. 14 is a side elevation of the engine which won the first prize at the 1853 Royal Show—and Fig. 15 is a cross-section of the arrangement.

The Burrell portable of 1853 was a handsome machine (Fig. 16), it had the shaped slide-bars which were featured on their engine at the Great Exhibition, and which were soon to be seen on their traction engines. The connecting-rod was still forked, to clear the bracket supporting the slide-bars, but the overhung crank of 1851 had given way to the bent crankshaft.

The water-pump was mounted on the side of the cylinder, and driven from the crosshead. This engine also received favourable comment from the judges at the "Royal."

Incidentally, the organisers of this event, the Royal Agricultural Society of England, had had—and continued to have—a considerable influence on the development of the portable steam engine, and the application of steam

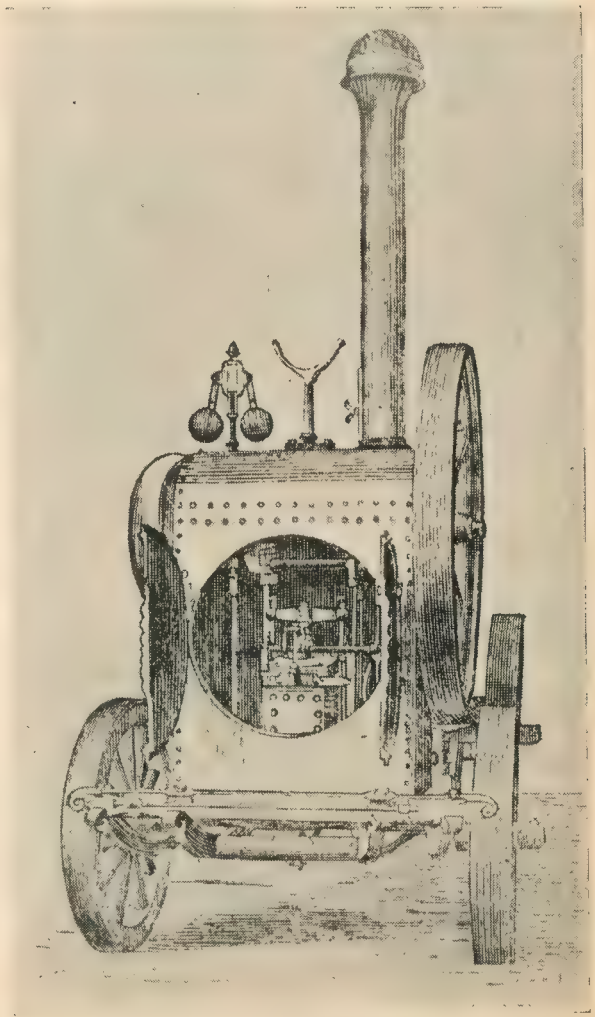


Fig. 13. The enclosed inverted vertical engine fitted to Tuxford's 1851 portable engine

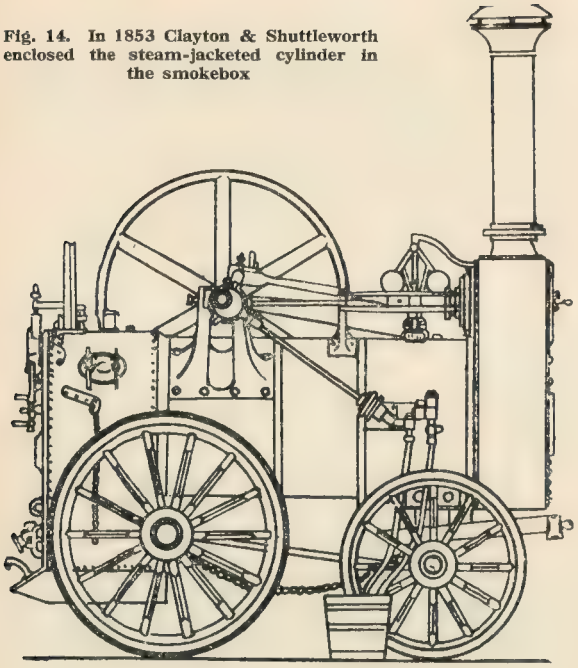


Fig. 14. In 1853 Clayton & Shuttleworth enclosed the steam-jacketed cylinder in the smokebox

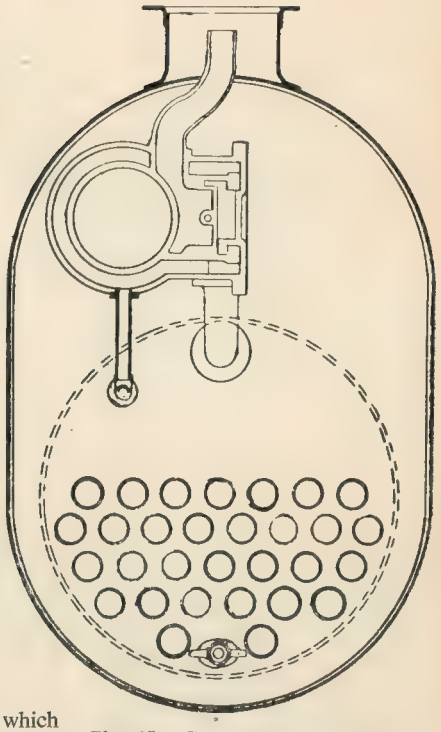


Fig. 15. Cross-section through C. & S. smokebox to show arrangement of cylinder

power in general to agriculture. The official history of the society, published at its centenary in 1939, makes this clear.

It says that the criteria on which judgments were made were mechanical efficiency, simplicity of construction, durability, safety, and cost. The routine efficiency tests determined the time, and the amount of fuel, required to raise steam, the brake horse-power developed, and the fuel consumption per horse-power hour. The judges, qualified engineers themselves, were able to give expert criticism and suggestions, which resulted in steady improvement. In 1848, for instance, their report stressed the importance of economy of fuel, and indicated the principles on which such economy depended.

That these principles were sound is evidenced by the fact that in 1849 the prize engine (a Garrett) burned 11½ lb. of coal per horse-power hour, but in 1853 the prize-winning Clayton only burned 4 1/3 lb. Concurrently the weight of the engines, in relation to their power, was reduced, and the design simplified in various respects.

However, at the 1854 meeting at Lincoln, the judges were still not satisfied, and the Society was advised to make regulations to ensure simplicity and easiness of access to the different parts. At this show, Hornsby's won the first prize, with a coal consumption of 4.55 lb. per horse-power hour. This was an eight-horse engine costing £255. Other prices were Ransomes and Sims (7 h.p.) £230, Clayton & Shuttleworth (6 h.p.) £220, and Garrett (6 h.p.) £234.

At Carlisle in 1855, the Senior Steward complained in his report that firms were producing special engines for winning the society's prizes—known as "racing" engines—and that these were not suitable for management by "intelligent farm servants." (Naturally, the builders sent their most experienced men with the engines!) This time the prize was won by Tuxford's with a consumption of 3.698 lb.

The stewards at Chester in 1858 reported that three makers had been ordered to draw their fires because the boilers of their engines were liable to burst, and eleven others had to reduce pressure to 45 lb., on their instructions. At this period, of course, there were many makers of the "village blacksmith" category, some of whom produced good engines, but some had very elementary ideas of mechanical and boiler construction!

It is also reported, in the R.A.S.E. Journal, that at Chester "one over-zealous engine-driver was detected in the act of appropriating a handful of cinders, in order to prolong the spark of life in his expiring engine; the consequence was that the culprit was immediately tried by a sort of drumhead court-martial, and expelled the yard." Did he, one wonders have to stand before his expulsion in the centre of a hollow square of fellow-drivers, whilst the buttons were cut off his overalls with a ceremonial weapon?

In the next article I hope to bring the story of the portable engine up-to-date.

*(To be continued)*

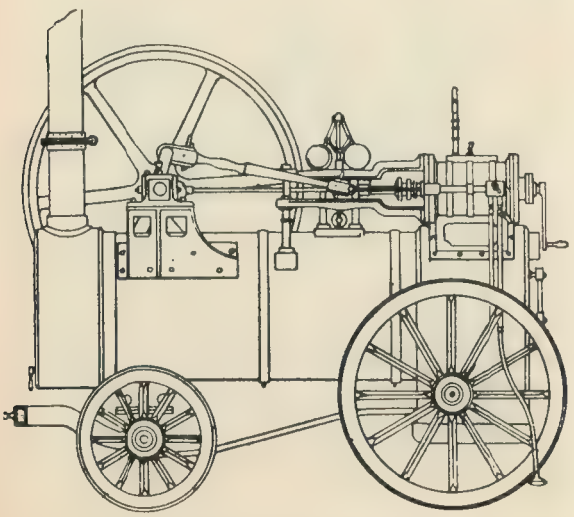
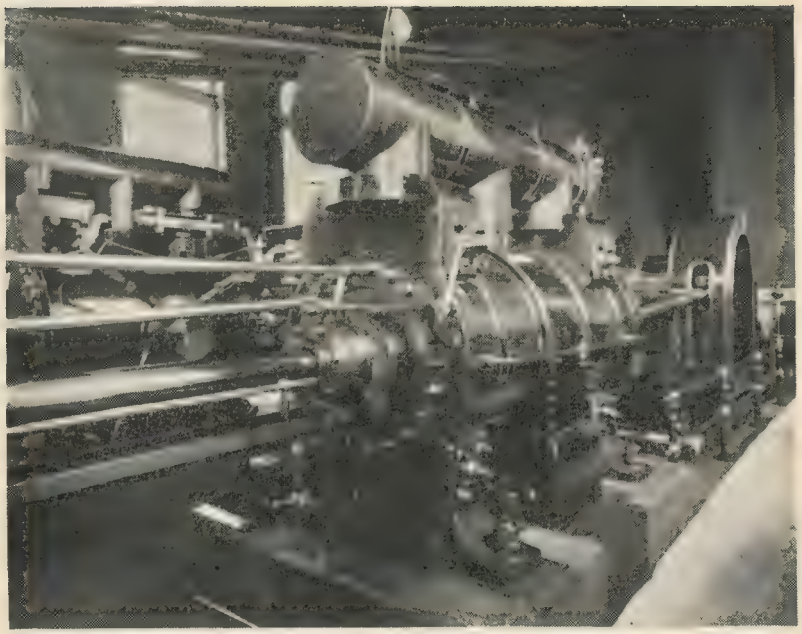


Fig. 16. Burrell's portable of 1853 had a "hairpin" connecting-rod and a crosshead-driven pump

# A Pair of Mill Engines

By

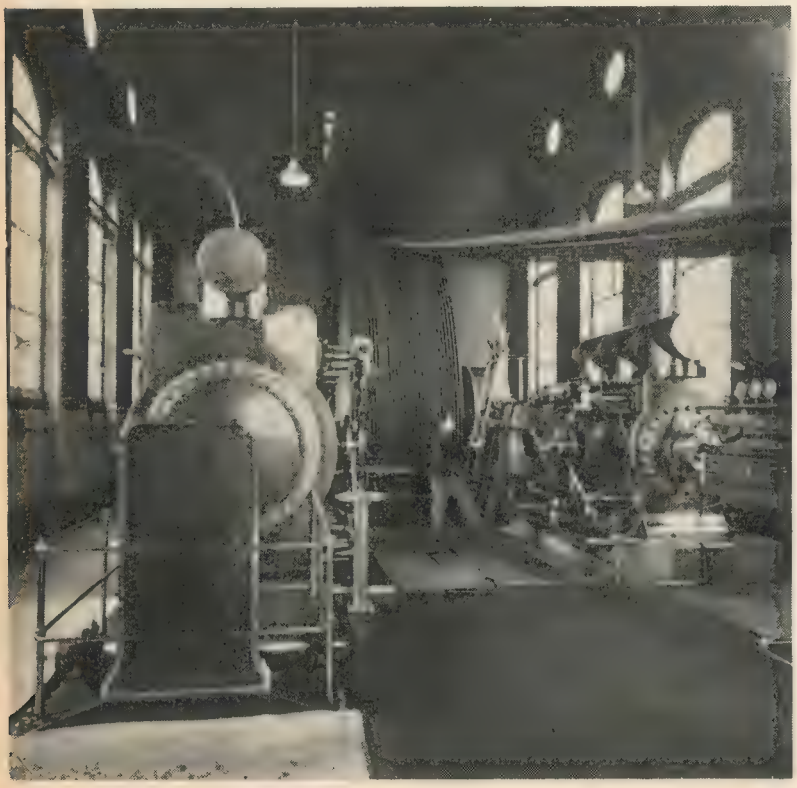
**W. Watson, A.M.I.E.E.**



THIS week's cover picture and the two reproduced here show different views of a pair of engines in a Lancashire spinning mill, and were taken just over 20 years ago when the mill was electrified. One would not think from the beautiful condition of these engines, that their day was done, but so it was.

I believe the indicated horsepower was about 1,500, the engines being of the cross compound, condensing type, with Corliss trip motion and, as can be seen, were built by that famous Lancashire firm of Hick Hargreaves, who are, happily, still extant, but who, unfortunately, no longer make reciprocating engines. I think I am correct in stating that this firm introduced Corliss gear to this country from America in the 1860s, and the design seen in the photographs could be mistaken for no one else's.

The picture above, shows the engine from the high pressure cover end. The tail-rod with slide bar is prominent, in accordance with first-class practice, and it is of interest to note the indicator pipes and cocks, and indicator reducing gear drive. Regular indication was a feature of Lancashire mill engineers, many engines being indicated weekly. A small but important point, often overlooked by model engineers, will be seen on the cylinder cover; I refer to the jacking-screw holes for cover removal.



The picture on the cover, shows the low pressure line from the crank end, the flywheel being lined with T. & G. boarding to reduce windage.

The picture on the left, shows both lines from the "cover" end, and from this one can note that the air-pump, under the engine-room floor, is driven by levers from the low-pressure tail-rod crosshead. The levers, etc., are hidden by the splash screen, but the fulcrum shaft and its bearings are visible.

The rope drive runs in two directions, part of it going up the usual rope race, and part back through the engine-house into an annexe.

These engines are governed on the cut-off of the high-pressure cylinder only; this determines the amount of steam used and consequently the power developed. The low-pressure cut-off can be adjusted by hand only, and simply serves to adjust the balance of power between the cylinders. Making the low-pressure cut-off earlier, increases the power developed in that cylinder and reduces that of the high pressure, since it increases the intermediate receiver pressure. For mill work, high-pressure governing is a perfectly satisfactory arrangement.

# USING THE LATHE AS A PLANER

**By S. E. Capps**

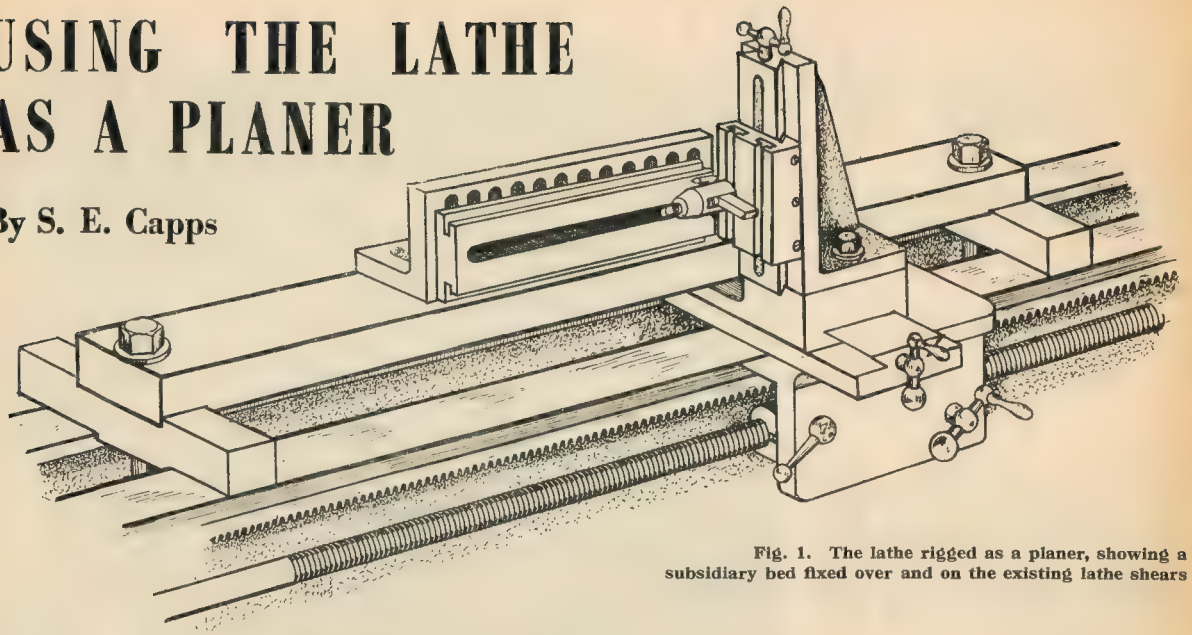


**Fig. 1. The lathe rigged as a planer, showing a subsidiary bed fixed over and on the existing lathe shears**

WHEN we acquire a lathe in the workshop, it is normally used for turning, screwcutting, and the drilling of holes that, because of their size, must be done in a lathe. Today, however, it is becoming an increasing practice to fit attachments to the lathe for milling, grinding, sawing and other operations, all of which enable these kinds of work to be done with little or no trouble, and with greater accuracy. In fact, we only need a planing attachment to turn the lathe into what many of us dream of—a complete machine shop in the one machine. Such an attachment, however, would be costly, and unless one has plenty of planing jobs to do, it would be an unnecessary expense. However, a lathe can be rigged for planing if one thinks it worth while.

It was during the first world war, when many centre lathes were rigged to do special jobs, that I converted one to work as a planer. The rig is shown in Fig. 1. As will be seen, a subsidiary bed was fixed over and on the existing lathe shears, high enough to let the saddle slide under. This sub-bed was a piece of heavy section steel, to which cleats were fitted at the ends, and rested on the lathe bed. These cleats were first shaped to fit between the lathe shears, and recessed out on the top side to fit the steel section. Fixing holes were accurately drilled through both section and cleat, and machine bolts fitted, long enough to pass between the shears and take a further cleat, with washer and nut, to tighten the whole up against the bottom of the bed. The sub-bed thus fitted gives a plain bed, along which the toolpost of the lathe can be tracked either by hand, or by the self-acting gear.

The work to be planed is mounted either direct on to the sub-bed, or to an angle-plate fixed to the sub-bed first. Suitable lathe tools can be used in the toolpost, and cutting obtained by sliding the saddle along the lathe bed with the tool adjusted against the work. This arrangement works well for odd jobs that require very little tool adjustment, but the work that can be done is limited by the amount of tool protruding from the toolpost that can be used without springing or chattering.

Furthermore, the vertical adjustment of the tool can only be obtained by using packing-pieces in the toolpost. The better method is to use a good vertical-slide fixed not to the top-slide, but to the cross-slide direct. A good heavy slide is to be preferred to a light one, and should be rigidly fixed to the cross-slide, so it cannot move under pressure from the tool when cutting. With this slide we have the vertical adjustment necessary for the cutting position of the tool, but the cross feed area that can be machined is still limited. In view of this, it is better to consider the machine as a side planer, and work it as such. This way, most of the planing can be done from the side, with the cutting tool overhang reduced to a minimum. The maximum area that can be planed will depend on the vertical movement of the slide.

For most small work, the standard lathe toolholder is used on the vertical-slide, but is rather light to be really rigid, and inclined to spring somewhat, although in my case, it was used for some time without trouble. Later, some small machine slides were planed in this machine, and the swinging type toolholder shown in Fig. 2 was made. This was a big improvement, and considerably more rigid in use: Tools of the shape shown were made as required. These may be a little more difficult to forge than ordinary tools, but with a little practice they can be shaped without much trouble. High-speed tools are definitely better than cast-steel tools for planing in this way.

In use, the back drag of the tool on the return to the start of the cut is relieved by the swing of the toolholder on all surfaces, except those facing away from the operator, such as the inside of the slide shown in Fig. 5. There is a little drag on the return stroke here, due to the one-sided pull

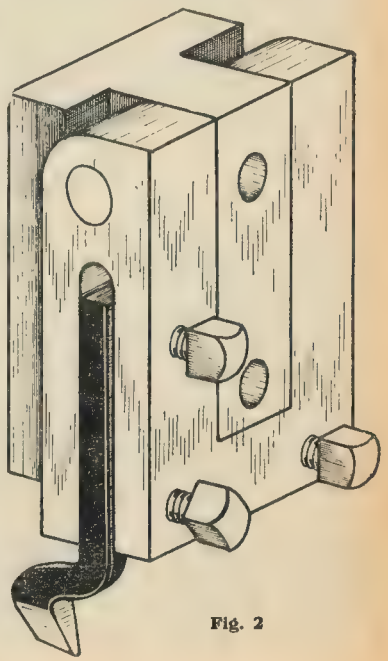


**Fig. 2**

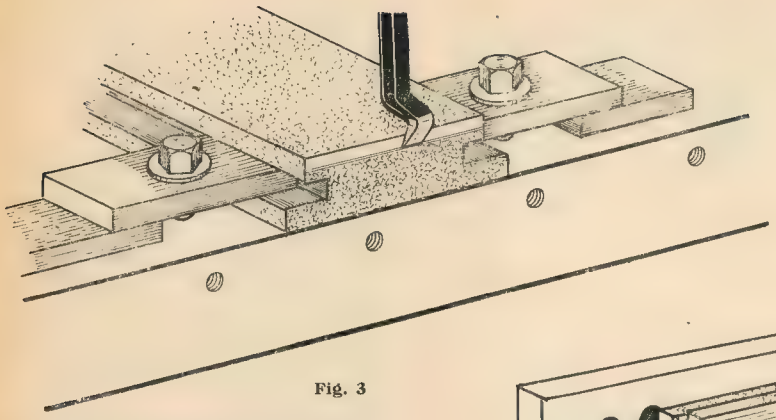


Fig. 3

of the sliding mechanism operating the saddle pulling the tool against the work; however, this can be reduced to almost nothing if the saddle is kept adjusted and free from slackness, but not tight enough to impede it sliding freely.

Both the vertical and cross-slides should be kept adjusted tight, and locked, when cutting, to prevent any grabbing or chattering of the tool. Methods adopted in fixing the work to the sub-bed should also be rigid and positive, as any looseness here will cause trouble by the job moving about, causing the tool to grab and possibly break. Furthermore, accurate work is

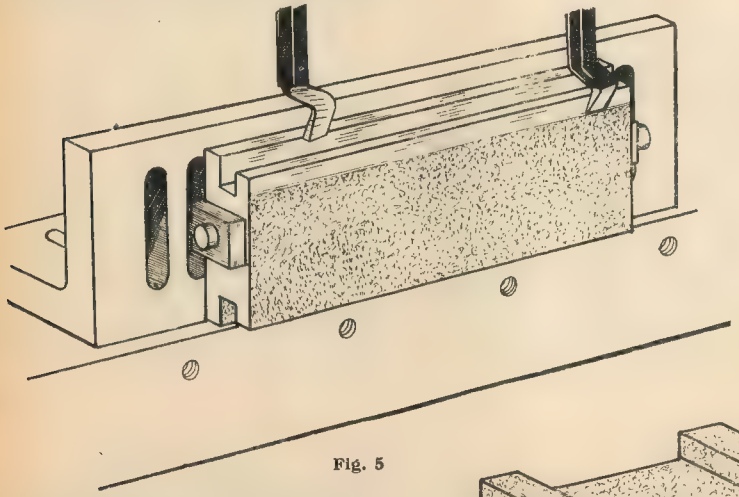


Fig. 5

impossible under such conditions. Two or three tapped holes in the sub-bed at suitable distances apart should be sufficient to provide the necessary fixing for jobs. Too many holes in the sub-bed should be avoided, as these will tend to destroy its rigidity, and cause it to spring.

Arrange all jobs on the sub-bed so as to be able to plane as much as possible from top to bottom on the side, and only across the work when it cannot be done any other way. The toolholder shown in Fig. 2 will hold tools vertically and horizontally, and side planing can be done with either of these positions. The toolholder should be of massive construction, with a large well-fitting hinge-pin. The tongue on the back and the toolplate should be tapered so that, in the cutting position, both should close together rigidly but be instantly free on the return stroke. A heavy, accurately-machined angle-plate should be used, as a light one will tend to vibrate if heavy cuts are taken on a job. If these points are given due consideration, planing can be accomplished without trouble.

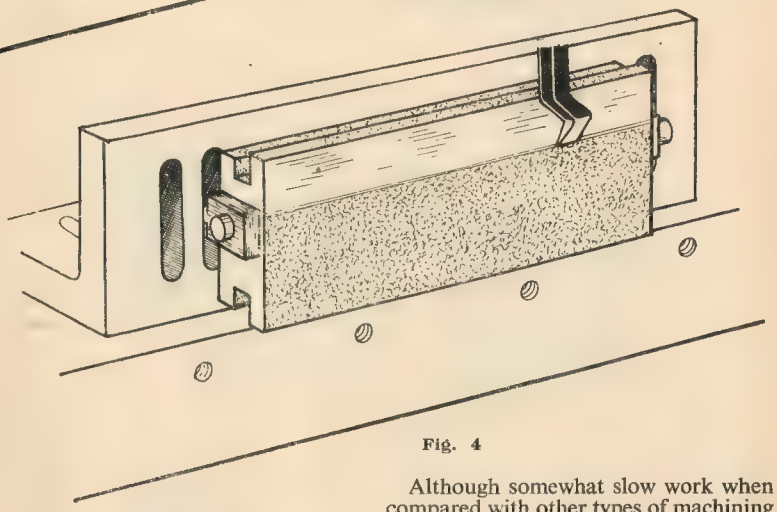


Fig. 4

Although somewhat slow work when compared with other types of machining operations, one can be assured of true work that would be very difficult, if not impossible, to obtain by hand methods. The sketches show the type of machine slide that was planed with the lathe rigged in this way. The slide parts were iron castings, and the sketches show the sequence of planing operations, all of which were carried out by side planing.

In planing cast-iron, always start by removing as much of the rough skin or outer surface as possible beforehand, as this outer skin can spoil tools very quickly. With castings of this nature, it has always been my policy to machine one part first, and where possible continue any other parts from it. In this way one can start the cutting tool

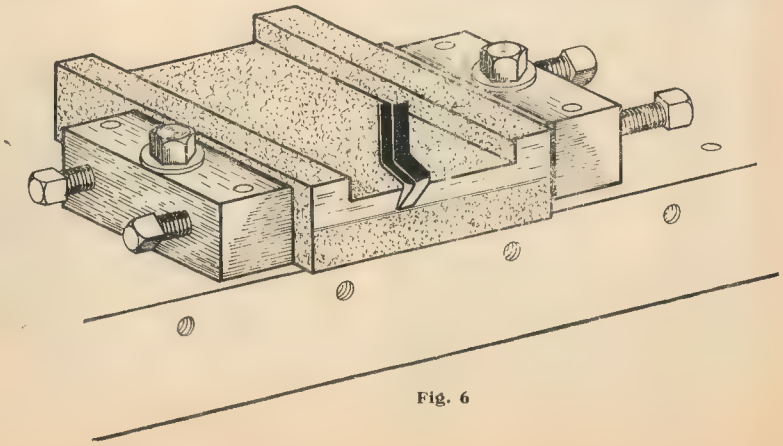


Fig. 6

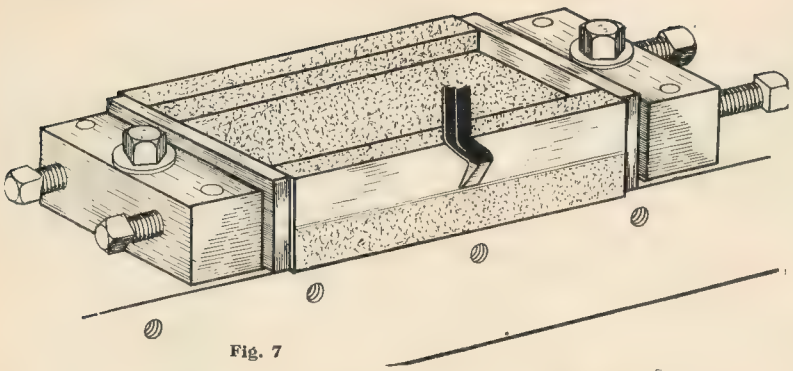


Fig. 7

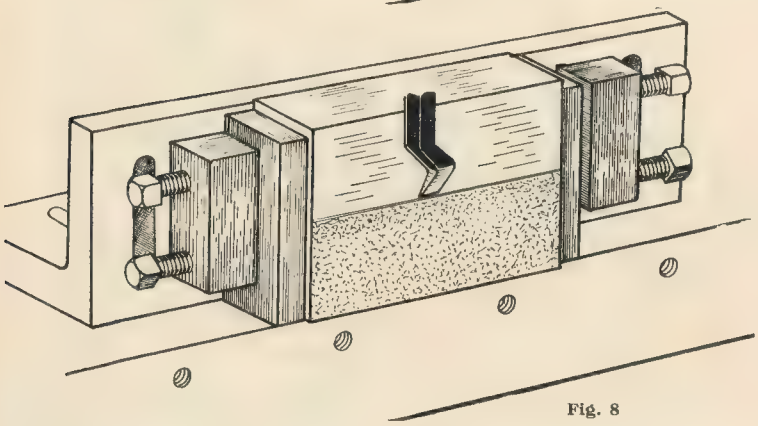


Fig. 8

on a machined surface, instead of starting on the outside skin each time.

This method was adopted with the slide in the sketches. Fig. 3 is the start of the job. The bottom part of the slide is mounted on the sub-bed direct, as shown, and the ends planed off. Set the cut to go well under the outer skin in the first cut, to get on to the clean metal. There may be a little chipping at the end of the cut, but this is removed in later operations.

After the ends are planed, the slide is mounted on the angle-plate for the next operation, the latter being first fixed to the sub-bed, and set true with the lathe bed. To hold the slide to the angle-plate, it is drilled for its feed-screw, and a well-fitting rod passed through the hole, long enough to project each end. Two screwed eye-bolts made from steel bar as shown in the sketch, Fig. 4, are put on the projecting ends, so as to pass through the angle-plate, and are tightened up with washers and nuts. This method holds the work very rigidly, and no trouble is encountered by its movement while planing.

In this position, the bottom is planed off. Several cuts down the surface will be necessary in order to get a flat true finish. When this is right, the slide is reversed on the angle-plate, and the top and sides planed. The type of tools that were used are shown in Fig. 5. That for the slide groove is made as a heavy-type parting tool. This allows both sides and bottom of the groove to be planed without changing the tool.

Note that this tool is not made to plane out the groove full width in one cut, but each side of the groove and the bottom individually. When this is finished, measure the thickness of the top, that is, from the face of the top surface to the inside of the groove, with micrometer or slide gauge, and note it carefully. The slide is now reversed on the angle-plate, and the other side or groove planed to suit the measurement taken.

In setting the slide on the angle-plate, make sure there is no dirt between the surfaces, or under the edges resting on the sub-bed. Provided that the fixing of the slide has been rigid, and it has been carefully planed, a good parallel job will result.

The top part is next set up and planed. This is held by steel dogs fixed to the sub-bed. The dog at the end of the cut against which the job is tightened is set square across the sub-bed, and dowelled in place. These dowels are short, so as to allow the dog to be removed. The other dog is also dowelled in the same way, but at various distances along the sub-bed, to accommodate work of different lengths. Fig. 6 shows the job set up between the dogs for planing the ends, and in Fig. 7 it is turned round to plane the sides.

Note that in this operation, packing-strips are placed between the work and fixing dogs, to obtain an equal tightening pressure over the whole of the end area. When this is done, the top surface is planed next. To hold the work for this operation, the angle-plate is used, with fixing dogs bolted to it, as shown in Fig. 8. Here again, packing-pieces are used to get an even grip from the dog screws.

The last part to be planed is the slide recess. Fig. 9 shows the arrangement for this. Note that only one packing-piece is used between the work and the tightening screws at the starting end. The edges are first planed off, with the tool in the vertical position in the tool-holder. To plane out the recess, two side tools, right- and left-handed, are used in the horizontal position in the toolholder, for rough planing, and the double-sided tool for finishing. This allows the whole recess to be finished with the one tool in the one setting. Note that the depth of the recess should suit the thickness of the slide on which it works. I have described this type of planing job as an example of what can be done with a lathe in this way, but I would point out that it is not the only kind of job possible with such an attachment. Later, I hope to describe others that have been planed in this manner.

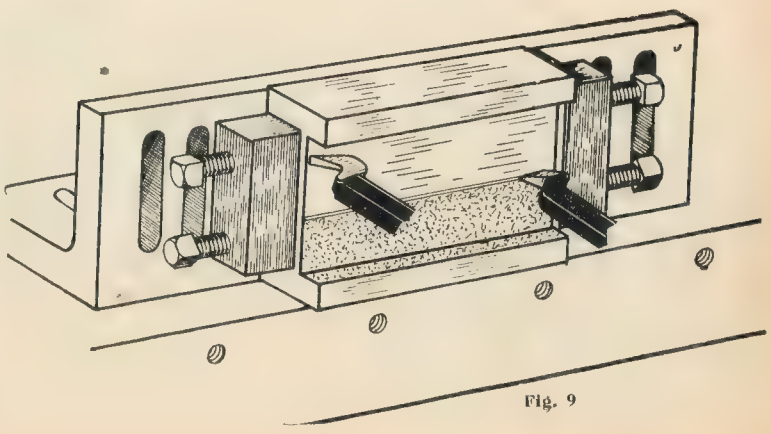


Fig. 9

# Unit Countershafts for Lathes

## By Martin Cleeve

RECENTLY, a case has come to my notice where the use of one of these unit countershafts (for attachment to the lathe at the rear of the headstock) has resulted in the burning out of the driving motor. This, apparently, was not caused by the use of the unit as such, but by a faulty adjustment of the belt-tensioning mechanism, which operates on a cam principle, this being so adjusted that when the belt from the motor and the belt from the stepped cone to the lathe were under tension, the countershaft frame casting, carrying the countershaft bearing bushings was distorted by this tension, so that the bushings were seizing the shaft.

In the case in question, there is no doubt in my mind that this seizing of the shaft was absorbing almost all of the full 1/3 h.p. output of the motor, so that during cutting operations the motor was being overloaded.

This is a point which might well go unnoticed, especially by those who have not, hitherto, found it necessary to rotate the headstock spindle and motor, etc., by hand-pulling the belt.

Moreover, in this case, the burning out of the motor was not caused by repeated motor switching, for stopping and starting the lathe, as a clutch had been fitted.

Two tension adjusting set-screws and lock-nuts are usually provided with the type of unit countershaft being discussed; one screw at the left-hand or motor pulley/clutch end, and one at the right-hand end.

The adjusting-screw which takes the greatest load is the left-hand one, which takes the pull of the motor belt, in addition to a share of the cone drive tension, whilst the right-hand screw should have, due to the nature of the arrangement, a somewhat minor steadying effect.

If I remember correctly, the belts are put under tension by the partial rotation of a shaft, which is provided with two flats on which the rounded heads of the set-screws rest, and, upon giving this shaft about 1/3 turn, the heads of the screws are caused to ride up on to the circular portion of the shaft; the screws being fixed to the movable framework of the countershaft, this moves with them and so tightens the belts.

Apparently this type of unit countershaft can give trouble by (1) being initially incorrectly adjusted (probably rare) and (2) wear on the adjusting-screw points and/or the rocker shaft and flats thereon.

In the case of (2), the left-hand adjusting-screw, etc., in taking most of the load, will wear first, with the result that the belt tension load will be gradually transferred to the right-hand screw, which, as already explained, can only tension the belts by transferring its lifting action through the framework, which consequently twists.

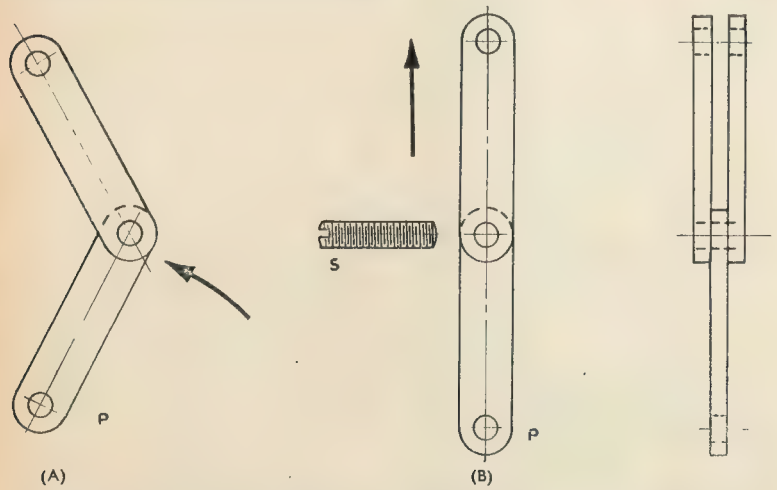
In view of this, it might be as well for readers who use this type of countershaft to check that the left-hand screw is taking its full share of the belt tension load, and to see that both screws are so adjusted as to compensate for any wear which may have taken place, and that the shaft *is* free to rotate when under tension.

Where this type of unit countershaft is not provided with a clutch, the user is placed in rather a dilemma, as the makers advise that the belt tension lever should not be used as a clutch, but should only be used to take the tension off the belt(s) during cone speed changes —probably because the parts are not hardened, and would soon "give up," and the electrical manufacturers say that the motor should not be started and stopped at very frequent intervals, as this will result in the motor heating up, with the possibility of a burnt-out starting winding; both, of course, being perfectly correct. Even so, I do not think the case is hopeless, and whilst an actual tested solution cannot be offered for those who cannot afford a clutch, perhaps it would be helpful to suggest that the belt tensioning arrangement be redesigned, making use of a straight-line toggle action, the principle of which is illustrated.

One such an arrangement in place of each "screw and flat" could be made to give the necessary lift to the countershaft frame, and could be used continually with every confidence for starting and stopping the lathe as, by the nature of this kind of linkage, the wear on the pivots is very slight.

Perhaps some readers have already carried out a conversion based on this or a similar idea; if they have, I feel sure that many others would welcome further details.

Whilst these self-contained drives are very convenient for those whose space is limited, I prefer a separate shaft mounted above the lathe, and, although I like to flatter myself by thinking that I have converted my M.L.7 into the 1995 model, ("Towards the Ideal Lathe," THE MODEL ENGINEER 6-1-55), I still retain the old-fashioned fast and loose pulleys for controlling the machine. This is due, partly, to retaining an original set-up of proved reliability and partly a matter of cost, but the main reason for its retention is that it is such a big advantage to have a comfortable length of belt on which to pull when it is necessary to rotate the lathe spindle by hand, as for threading a screw or checking a set-up on the faceplate.

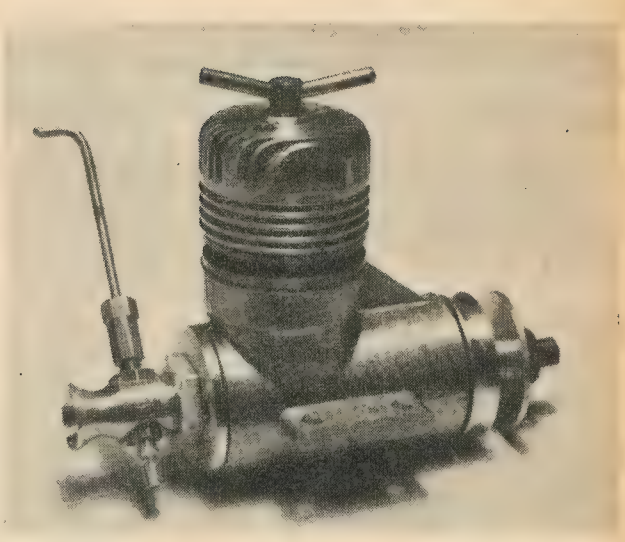



**Illustrating the principle of the toggle action. Links arranged as at (A) and pivoted at P to any convenient fixed point on the machine are capable, upon being straightened as at (B), of imparting a powerful lifting action to any part to which the upper end may be coupled. A stop-screw, S, prevents the collapse of the links on that side, and, incidentally, may be so adjusted that the lightest push from that side S will bring about the collapse of the links, even when they are heavily loaded**

# Notable Model I.C. Engines

## THE ELFIN B.R. SERIES

### By P. G. F. Chinn



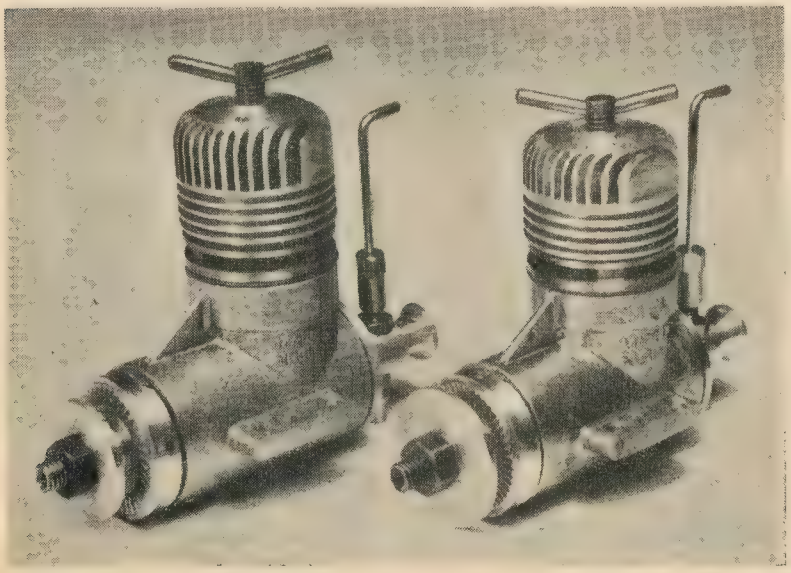
The Elfin 1.49 is the first British commercial reed-valve engine

IN our previous article in this series, we dealt with the American Cox 0.049 engine, a design with many unique features, the most noteworthy being its reed-valve induction system. The success of this engine, introduced in 1952, was a signal for many people to begin experimenting with reed-valve conversions of existing units, but many of these experiments were conducted in a somewhat haphazard manner and, for the most part, resulted in no appreciable gains over normal rotary-valve induction and were usually far less reliable.

The reed-valve naturally also claimed the attention of other manufacturers, a few of whom have investigated its possibilities in connection with their existing products. Messrs. Aerol Engineering of Liverpool, makers of the well-known Elfin model compression-ignition engines, are, however, the first British manufacturers to put a reed-valve engine on the market. They are also the first to market a reed-valve compression-ignition engine. Added to this, their new engine is an entirely new design and is a marked break away from the general run of model compression-ignition engines.

**Three Models**

The Elfin B.R. series, as these engines will be known, is being marketed in three models, viz.: 1.5 c.c., 1.8 c.c. and 2.5 c.c. The first two of these are already on the market and the larger model is expected to be ready by the time these words appear. These capacities correspond to those of the previous shaft-rotary-valve, plain bearing Elfin models which first began to appear in 1948 and which, incidentally, contributed a great deal towards the development of light-weight, high performance model diesel engines. Our following comments apply primarily to the 1.5 c.c. and 1.8 c.c. models.



The 1.8 and 1.49 air-cooled models. Water-cooled versions, having two-piece brass water-jackets in place of the finned barrel and head, are also available

**Simpler Design**

Although, like the Cox engine, the Elfin reed-valve and carburettor assembly also comprises nine individual parts, it is of a somewhat simpler design. Only one valve reed is used and no backplate is employed, while the needle-valve is of a conventional spray-bar pattern. The various components are assembled on the crankcase rear cover. This is deeply recessed to accommodate the valve plus a short compression spring and circlip, which hold the rim of the valve firmly in place. The intake port is disposed centrally in the crankcase cover and the carburettor body screws into this, being locked in position with a hexagon nut. This allows the carburettor to be rotated through 360 deg. about the centre-line of the engine, bringing the needle-valve stem to any convenient position.

The crankcase of the Elfin B.R. 1.5 and 1.8 is an extremely rigid die-casting in aluminium alloy and is of somewhat unusual design. Since clearance is no longer required for a front (crankshaft valve) intake, the crankshaft has been shortened and crankcase overhang has been further reduced by moving the mounting lugs forward. The crankshaft runs in two ball journal-bearings of equal size and the drive to flywheel or airscrew is *via* a tapered section at the front end.

The cylinder porting is of the radial type, there being three exhaust slots and three transfer ports disposed between them. The latter are inclined at 53 deg. to the cylinder axis and are fed through narrow vertical channels in the outside of the cylinder wall. At top dead centre the piston skirt uncovers the exhaust

belt, opening the crankcase to atmospheric pressure to supplement normal induction. The ports remain open for approximately 45 deg. of crank angle on the 1.5 c.c. model and approximately 55 deg. on the 1.8 c.c. unit. Both engines employ the same carburettor design, the choke areas being identical.

**A Practical Advantage**

The cylinder liner, which is of nickel-chrome steel, screws into the crankcase. The finned duralumin cylinder barrel of the air-cooled models is a sliding fit over the upper portion of the liner and is secured by a duralumin cap which screws on to the top of the liner, but is neatly recessed into the vertical head finning. The use of vertical head finning on a model compression-ignition engine is uncommon and adds a pleasing touch to the appearance of the engine. A practical advantage of this arrangement is that the cylinder barrel does not tend to unscrew while the engine is running —a common complaint with model diesel units having the popular screwed on cylinder barrel/head.

These Elfin engines are also available in water-cooled marine versions. Water jackets comprise a 1½ in. diameter head and outer jacket machined in two parts from hard brass. Water circulates in direct contact with the cylinder wall. Flywheels, also machined from brass, are 1.75 in. diameter by 0.375 in. for the 1.5 c.c. and 1.8 c.c. models and 2 in. diameter by 0.5 in. for the 2.5 c.c. model.

The 1.5 c.c. engine, known as the "1.49," has a bore and stroke of 0.503 in. by 0.460 in., giving an actual swept volume of 1.498 c.c. The 1.8 c.c. unit, known as the "1.8," has the same bore measurement but stroke is increased to 0.562 in., giving an actual capacity of 1.830 c.c. Provision for the greater crankshaft throw with the longer stroke engine is made by machining a groove in the cranckase. This gives adequate clearance for the connecting-rod big-end and, while appearing to leave the crankcase wall rather thin at this point, has evidently proved satisfactory.

**Bottom end parts, showing the robust crankcase, housing two crankshaft ball journal-bearings, and the rear cover with carburettor and valve parts assembled**

The departures from orthodox practice which mark this new Elfin design are most certainly justified by the general performance and handling characteristics of the engine. Compared with the earlier shaft valve 1.49 model, which, itself, was of exceptionally good performance, the new reed-valve engine shows a higher output over the entire r.p.m. range. The improved torque at lower speeds is particularly noticeable. Maximum output on test was at the outstandingly good figure of 0.160 b.h.p. (an average of two engines tested) at 13,500/14,000 r.p.m. This, the equivalent of 107 b.h.p. per litre, is about 25 per cent. better than the average popular 1.5 c.c. model compression-ignition engine, and is largely attributable to the exceptionally good b.m.e.p. developed which reaches some 60 lb./sq. in. at between 8,000 and 9,000 r.p.m. Starting is very easy and the units tested showed pleasant running qualities.

**Radial cylinder porting is used, with conical crown piston and transfer passages cut in the lower threaded portion of the liner. An unusual cylinder finning arrangement is featured by the air-cooled models**

**Carburettor and reed-valve parts, showing the crank-case cover which also forms the reed-valve housing, reed. compression spring and retaining circlip**

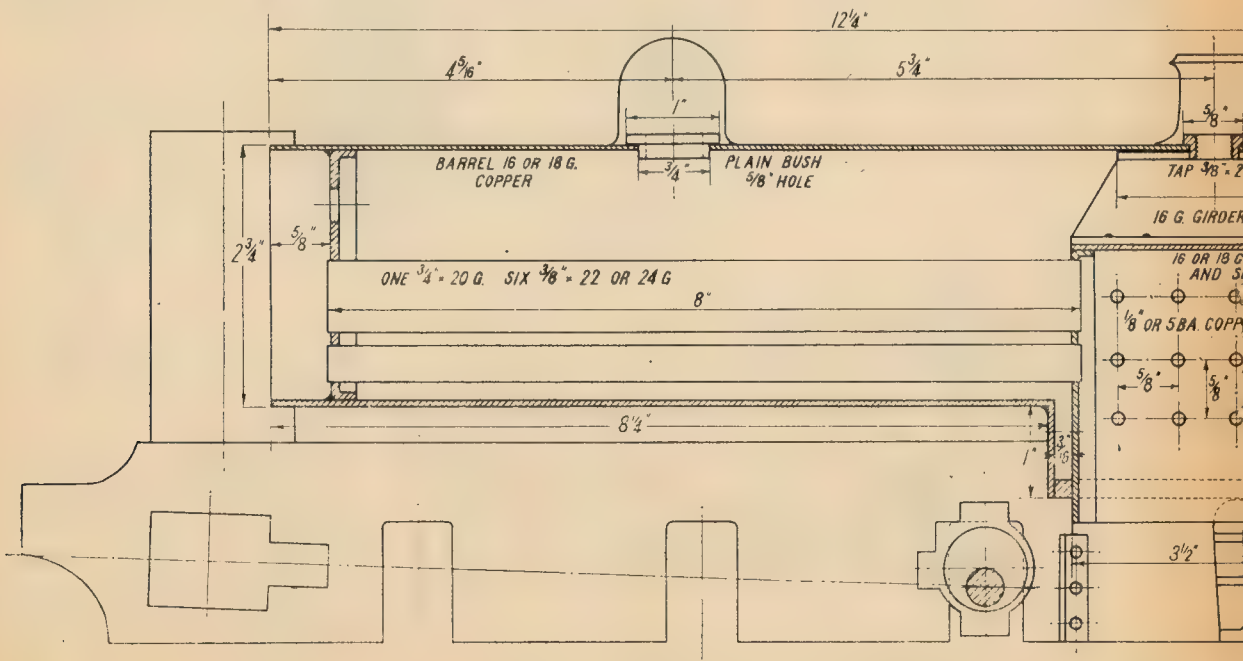
# L.B.S.C.'s "Netta"

## BOILER FOR THE 2½-in. GAUGE ENGINE

ALL good engine-drivers try to make up lost time, if it can be done with safety, and without damage to the engine; so I'm now trying to pick up a little of the time lost on the *Netta* instructions, when I was unable to make any drawings. The next item on the agenda being the boiler for the middle quin, I managed to draw it out, though at time of writing, it is still difficult to push the draughting-machine scales with my left hand, and hold them still while operating the pencil. I guess there will be a loud cheer from Inspector Meticulous and his friends, when they see that I have kept the outside dimensions of the boiler to the correct proportionate size for 2½-in. gauge. In case any of the querulous fraternity have any doubt about the steaming capacity of the boiler, they may be interested to learn that I have here, at the present minute, a locomotive with the same diameter of boiler barrel, same tube arrangement, *and a much smaller firebox and grate*. She makes steam enough to haul two adults at high speed, with the pump feeding, and enough extra to blow the whistle; so there is no question, that the boiler shown will do the needful with ease. In the past, also, quibbles have been raised about boilers not clearing the hornblocks, frame stays, and so on; so this time I have shown the whole box of tricks in position on the frame, with the highest eccentric position, the frame stay, and trailing hornblock. Builders can see at a glance, that it fits in and clears everywhere. The foundation ring rests on top of the hornblock castings, and the bottom of the firebox comes level with the tops of the cheeks. As the ashpan will not be as wide as the firebox, it will fit easily between the axleboxes. So much for that.

### A "Standard" Job

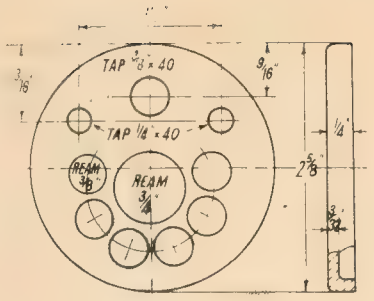
It will be seen that the boiler follows the "L.B.S.C. Standard" in design and construction; incidentally, it makes me chuckle when anyone starts to claim "standards" on the strength of building, or partly building, two or three locomotives! The boiler shell and firebox wrapper are made from a single sheet; it cannot be made from a piece of tube split down and opened out at the firebox end, the sides being too deep, unless a strip is added at the bottom, which means an extra joint at each side, and should be avoided. The smokebox tubeplate is recessed into the barrel, to give increased smokebox capacity, and allow room for the superheater header and connections; something big sister never had. Properly-flanged joints are used throughout, except where the throatplate meets the underside of the barrel; and as the throatplate fits inside the barrel, and bears against the edge of it, all pressure tends to hold the joint in closer contact, instead of tearing it apart. I am specifying a backhead ⅛ in. thick, to eliminate the need of bushes for fittings; they can be screwed straight in. The old North-Eastern went in for circular fireholes, so this feature is all-present-and-correct-sergeant. I don't think there is anything else to which I need call attention; a 2½-pint blowlamp, or a 1-in. air-gas blowpipe, should provide all the "therms" needed for brazing, although a larger one, or oxy-acetylene apparatus, would naturally make easier work of it.




**Longitudinal section of boiler for the 2½-in. gauge engine**

A piece of 16- or 18-gauge sheet copper, measuring $12\frac{1}{4}$ in. × 9 in. will make the barrel and wrapper; 18-gauge will be plenty strong enough for this small kettle. The boiler of my $3\frac{1}{2}$-in. *Grosvenor* is made from 18-gauge copper, and stood test perfectly; *Ancient Lights* also has a boiler of same thickness. Cut the piece as shown in the small detail illustration, anneal if at all hard, then bend to shape around a piece of wood, iron pipe, or anything that may be handy and of suitable diameter. Young Curly of the golden mop bent tin boiler-barrels around ginger-beer bottles. Lap over the ends of the barrel portion, sufficiently to bring the outside diameter to $2\frac{3}{4}$ in. ("mike" measurements not needed) and put $\frac{1}{16}$-in. copper rivets through at about $\frac{1}{2}$ in. intervals. Rivet up on a bit of bar held in the bench vice, and projecting from the side of same; if you take out one of the hard insets, and rest the bar on the ledge, it won't slip while you knock down the rivets, and may save new words being added to the dictionary of railroad Esperanto. Fancy heads are not needed, as they should all be filed off when the brazing operation is completed. The firebox wrapper can then be bent to the shape shown in the illustration.

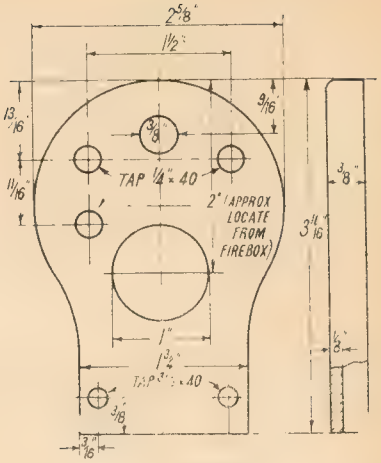
The throatplate can then be fitted; but before cutting out the piece of 16-gauge copper, it is a good wheeze to cut out the iron former over which the backhead is flanged, as the throatplate can also be flanged over the lower part of it. In response to requests from beginners, I have included a dimensioned drawing of this, also the firebox former, so that they will have no difficulty in



Smokebox tubeplate

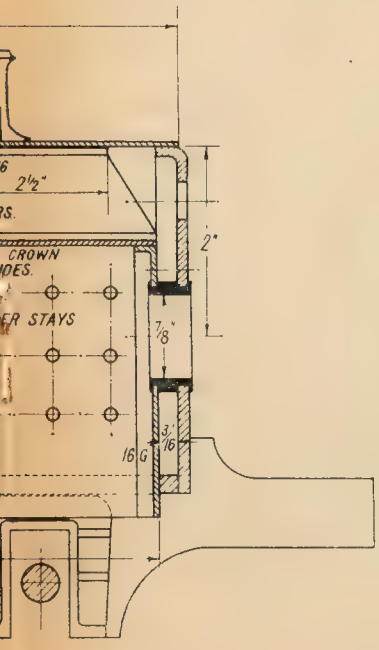
getting the flanged plates exactly the right size. Cut out the throatplate blank to the dimensions shown, leaving $\frac{1}{4}$ in. extra at each side, to form the flanges, which can then be made by clamping the blank and former together in the bench vice, and hammering down the projecting edges of the copper, on to the former. File off any raggedness, then insert the throatplate between the sides of wrapper at front end, so that the curved edge just shows above the inside of the barrel, and butts up tightly against it. Put four $\frac{1}{16}$-in. copper rivets through wrapper edge and throatplate flange at each side, to hold the throatplate in place whilst the first brazing job is under way.

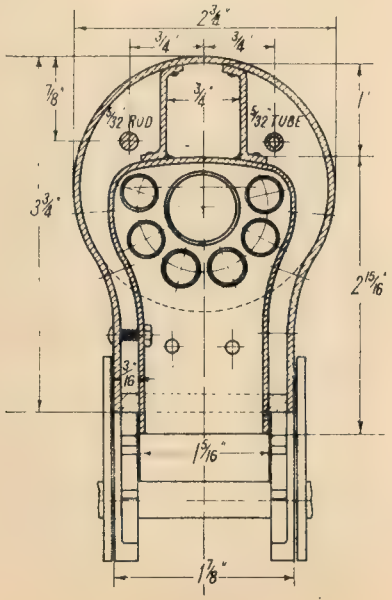
The longitudinal seam and the throatplate joints can then be brazed. Anticipating the inevitable beginners' queries as to whether silver-solder can be used for the whole lot, it can, provided that a coarse grade, such as ordinary No. 3 (which is an alloy of two parts brass to



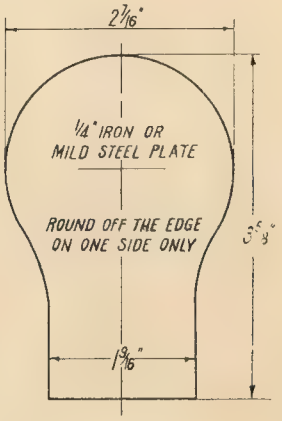
Backhead

one of silver) or Johnson-Matthey's B6, is used for the barrel and firebox joints; and best grade, or Easyflo, used for tubes, backhead, and foundation ring. If one grade only is used for the lot, there is a risk of the first joints cracking open when the other jobs are being done; many beginners have found this out, to their dismay. For ordinary brazing or silver-soldering, just stand the boiler shell barrel upwards, in a pan of small coke or breeze, piling up the coke to the level of the throatplate on the outside, and within an inch of it on the inside. The joints should be well anointed with wet flux, inside and out. Boron compo, or powdered borax, mixed to a paste with water, will do for both brazing strip, or coarse silver-solder.

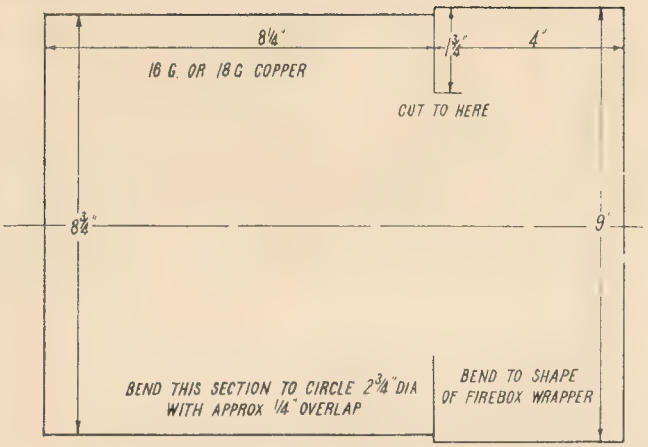


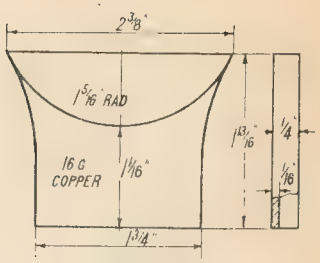
Cross section through firebox



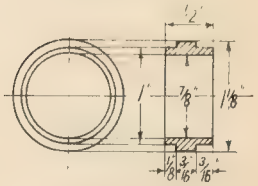
Backhead former




**Boiler shell in-the-flat**




**Throatplate**




**Firehole ring**

Tip to beginners: Get your blowlamp or blowpipe going good and strong, and have your tools all ready, so that the job is completed non-stop; if the work is allowed to cool, whilst you go searching for something, or if the lamp goes out, there is a risk of spoiling it. A pair of tongs, a length of stiff wire with a point at the end, a tin with some dry flux in it, and the brazing material, should all be well within reach. I hope that our experienced readers will forgive all this repetition, but I'm continually receiving letters from newcomers to our craft, who ask for the information, and life's too short to carry on a free school of correspondence. The very word "brazing" scares them stiff, especially after they have been talking to Mr. I. Knowitall, yet the job is *easy*. Simply heat up the whole of the joint, moving the flame about, until the wet flux dries out and starts to fuse or glaze; then concentrate the flame on one bottom corner of the throatplate, and when it glows bright red, apply the end of the strip of brazing material, or silver-solder, to the joint, in the flame. If the copper is hot enough, the strip will melt at the end and run into the joint. Move the flame along a wee bit, and repeat operation, carrying on until you reach the barrel; then go along the joint between barrel and throatplate, allowing enough brazing material to melt into the joint, to form a fillet. When the other end is reached, either work downward to the bottom corner, or make a fresh start there, and work upwards, until the barrel is reached; just as you fancy. Make quite certain that plenty runs in at the end of the joint where throatplate joins barrel at each side. Dip the brazing strip in the flux before applying.

When you are certain that all is O.K. grab the boiler shell with the tongs, lay it in the coke, joint upwards, and seal up the seam in similar fashion, starting at the end and working your way slowly along; be careful to cover all the rivet heads. When the throatplate is reached, play the flame on the junction point until the melted metal thoroughly amalgamates and leaves an unbroken joint. Should it bubble or "spit," scratch in the melted metal with the pointed wire, to break up any borax bubbles, which would render the joints porous. Let it cool to black, then quench the lot in acid pickle, wash off in running water, and clean up with steel wool or domestic scouring powder. The heads of the rivets can then be filed smooth. Easy enough, surely!

Cut out the iron former plate to the dimensions shown, rounding off one edge; then cut out two pieces of 16-gauge soft sheet copper, ¼ in. larger all around except at bottom. Clamp each in the bench vice alongside the rounded-edge side of former, and beat down the projecting ¼ in. on to same. Before removing the first, run the No. 40 drill through the holes in the former, right through the copper, and smooth off any ragged edges. The other piece has a 1-in. hole drilled in it at 1⅛ in. from the top as shown. Beginners who haven't any big drills can make a smaller hole and open it with a half-round file (position of hole should be previously marked out) or drill a circle of little holes and break out the piece, finishing with file. Same applies to the ⅞-in. hole in the tubeplate; the smaller holes should be drilled 23/64 in. and finished off with a ⅜-in. parallel reamer, but don't put it through too far, as the tubes should be a tight fit at the firebox end. The tube holes should touch the flange, and should be countersunk on the opposite side.

The firehole ring is made from a ½ in. length of 1⅛-in. copper tube, ⅛ in. thick. Chuck in three-jaw and turn a step at each end as shown, leaving a full-diameter piece 3/16 in. wide between them. Push the ⅛-in. step through the hole in the firebox doorplate, and beat down the projecting lip on to the inner side of the doorplate, until same is clamped tightly against the shoulder, as shown in the section.

The exact length of the piece of 16- or 18-gauge copper for the sides and crown of the firebox, can be obtained by running a piece of fuse wire, or soft copper wire, around the flange of the tubeplate, and straightening it out. The width is 3½ in. An easy way to bend it is to mark the position of the top bends, then put a bit of rod about ⅝ in. diameter in the bench vice, with about 4 in. projecting from the side; lay the plate on the rod, with the marked line directly over it, and press down at each side with your hands. After making the second bend, squeeze the lower part to the shape of the end-plates, and rivet them in place with a few 1/16-in. copper rivets at about ¾ in. centres, so that they will "stay put" while being brazed. Then cut the two girder crown stays to the shape shown, from 16-gauge copper; bend the flanges in the bench vice, and rivet the longer ones to the firebox crown, at the spacing shown in the section, using 1/16-in. rivets at ½ in. centres.

The ends of the tubes should be faced off in the lathe. If the hole in the mandrel is too small to allow them to enter when held in the three-jaw, support the outer ends while facing, by an improvised L-shaped wooden steady, as described several times previously; two bits of wood screwed together, with a hole for tube-end drilled at centre height, the bottom of steady being held to lathe bed by a bolt. Clean both ends of tubes with coarse emerycloth.

The smokebox tubeplate is knocked up from a circle of 13-gauge sheet copper, 3⅛ in. diameter, over a circular former 2½ in. diameter. Chuck in three-jaw, flange outward, and face off the ragged edge; then reverse, and rechuck on the outside of the jaws. Turn down the flange to a tight fit in the boiler barrel. Clamp the firebox former to the tubeplate, with the No. 40 holes corresponding to the position of the tube holes as shown in the drawing; run the No.

(*Continued on page* 363)

# Machining Simple Worm-Wheels

By "Duplex"

IN a previous article, an account was given of making a worm with a standard V-thread, and the machining of the corresponding worm-wheel can now be described. The method used is that illustrated in the accompanying photographs, and consists essentially in driving a standard, parallel tap in the lathe and allowing it to revolve the wheel blank in step while cutting the teeth to the required depth. It must, however, be understood that, by relying on the tap to turn the blank, some slip must inevitably occur, and this may lead to one or more teeth being cut in excess of the calculated number. Nevertheless, we have machined a large number of worm-wheels in the way described, and have never experienced any difficulty in producing wheels, with apparently regular teeth, that have given satisfactory working. The only limitation, then, is that by this method it is not possible to ensure that the finished gearing will give an exact reduction ratio, but for most ordinary purposes this is of little importance. In commercial practice, the method usually adopted for machining worm-wheels is to gear the hobbing cutter to the wheel blank, so that both are maintained exactly in step, and the number and spacing of the teeth are then in accordance with the calculated values. However, this method calls for a somewhat elaborate and complicated driving gear which is outside our present purpose.

The worm-wheel can be made of either cast-iron, mild-steel, bronze or duralumin, and we have found the latter material to have good wearing qualities under favourable working conditions and, besides, it is readily machined to a good finish. If the worm is $\frac{1}{2}$ in. in diameter, the blank should not, in the first instance, be made less than some $\frac{3}{8}$ in. in width, in order to enable the threads of the tap to engage sufficiently to rotate the wheel. The blank is faced on both sides and bored to fit a standard taper mandrel, so that it can be mounted between centres for turning the periphery concentric and to the required diameter. In a tap of 16 t.p.i. the crests of the threads are, of course, spaced $\frac{1}{16}$ in. apart and, as they roll against the blank, they will bridge a small portion of the circumference, corresponding to a chord of the circle. This chord, being a straight line, will be slightly shorter than the corresponding distance measured along the circumference of the circle. As this discrepancy is usually offset by that resulting from slip in machining, it can for all practical purposes be disregarded, bearing in mind that the tap will to some extent compress the metal and thus correct the tooth form throughout the circle. The action of the tap is somewhat akin to that of a knurling wheel, which produces regular and evenly-spaced indentations without the need of having to calculate the overall diameter of the work.

The outside diameter of the wheel blank, for the present purpose, is calculated as follows :—

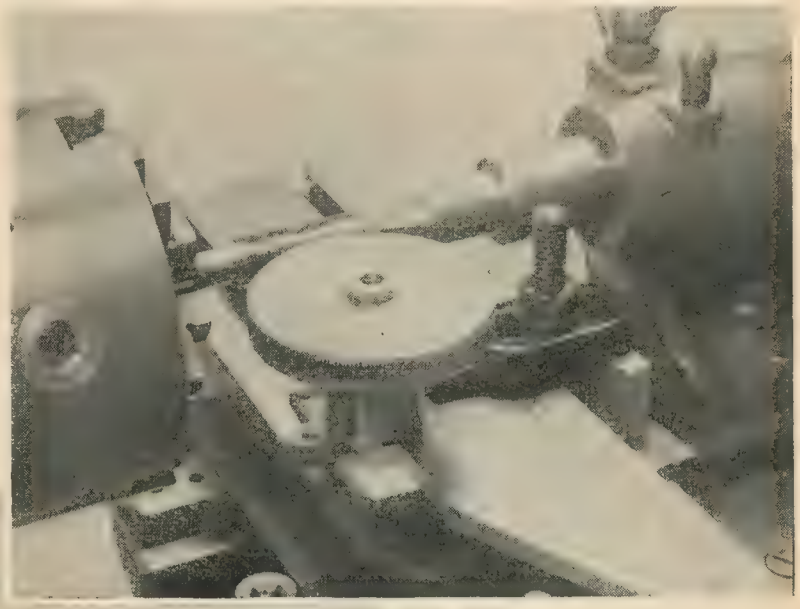


Fig. 2. Cutting the worm-wheel teeth with a tap driven by the lathe mandrel and the blank pivoted on the cross-slide

Fig. 1. Three worm-wheels machined in the lathe

Where $x$ = dia. of blank

$\pi = \frac{22}{7}$.

number of teeth = 120

pitch = 1/26 in.

Then $x = \frac{120 \times 7}{26 \times 22}$

$= 1.469$ in.

The accompanying photographs illustrate various methods used for driving the tap and mounting the worm-wheel; but to obtain regular cutting, the tap

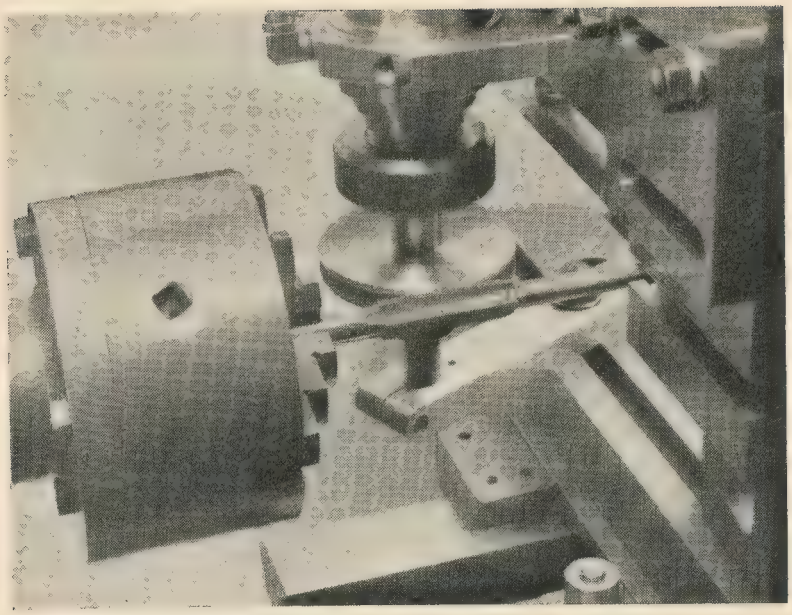


Fig. 3. The blank mounted on the spindle of the lathe milling attachment

should be accurately centred, preferably, by mounting it between centres and driving it from the lathe catch-plate. The attachment, illustrated in Fig. 5, for mounting the blank at centre height, consists of the standard Drummond toolholder secured to the saddle fitting described in a previous article. This fitting is held in place by means of four T-bolts, and does not rely on the less rigid form of mounting provided by a single, long, central bolt.

A plate to carry the wheel blank is secured to the toolpost by using the standard clamp-bolts. As shown in Fig. 6, the main pivot bolt carries a bushing to fit the bore of the blank, and the assembly is secured with a lock-nut. To locate the blank, a domed nut is fitted to the pivot bolt, and this is also secured with a lock-nut after the blank has been set to rotate freely.

This form of carrier can be made to accommodate blanks of various dimensions; for this purpose, different sizes of pivot bushes are provided, and the plate itself is slotted to enable the blank to be mounted with its outer edge well

Right: Fig. 6. Showing the construction of the pivot for mounting the blank on the Drummond toolholder

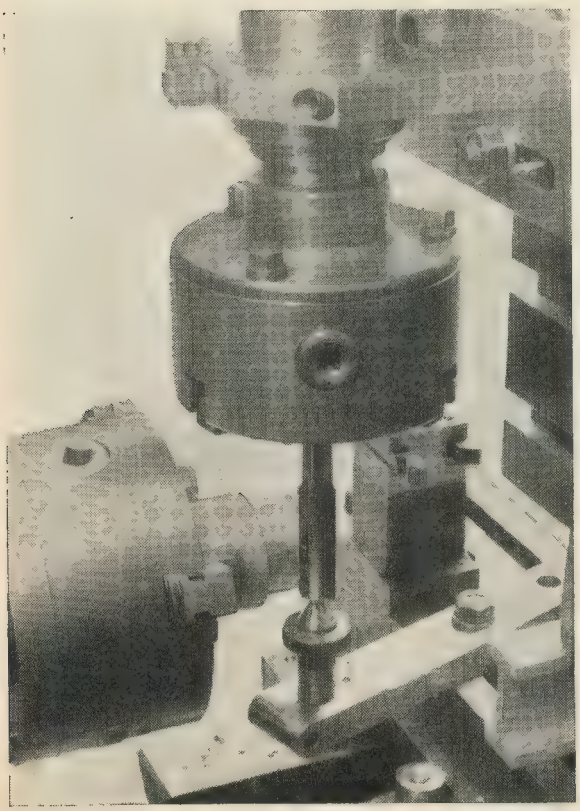


Fig. 4. The blank mounted in the chuck and the tap driven by the millin attachment

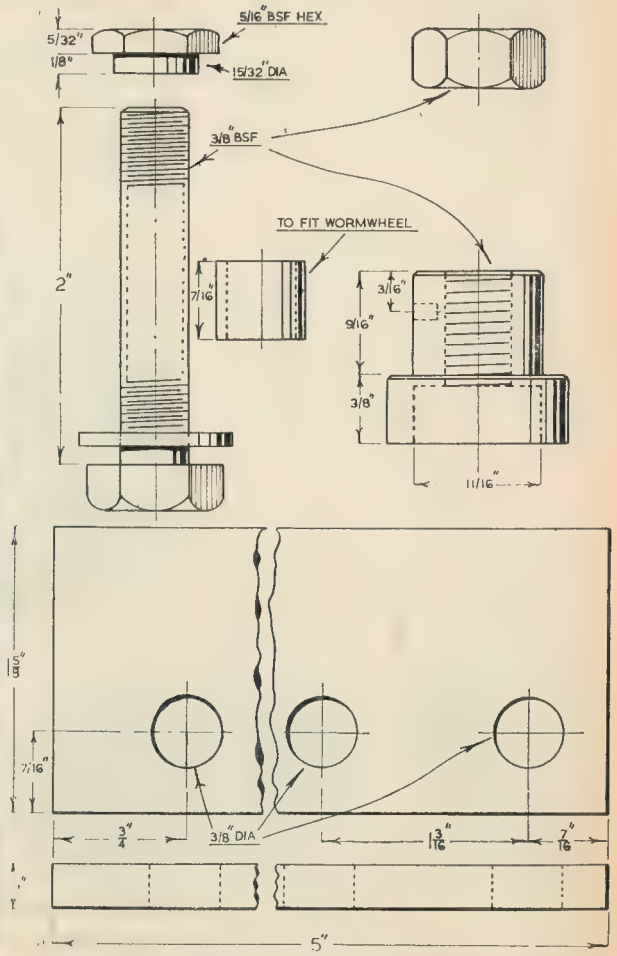



Fig. 7. The plate attached to the toolholder for carrying the pivot bolt

supported from below, in order to resist the downward thrust exerted by the tap.

At the start of the machining operation, the blank is fed forward to make contact with one of the threaded lands of the tap, and the cross-slide index is set to zero. The tap is then rotated to bring one of the flutes opposite to the work, and the slide is fed forward for some 10-thou. in.

If the lathe is now started, the tap will cut deep enough to rotate the blank as the teeth are formed. Mark the starting point on the blank with a grease pencil, and at each revolution increase depth of cut by, say, 5-thou. in.

This is continued until the full tooth depth is reached; that is to say, $\frac{0.64}{26}$ in., which is approximately 25-thou. in.

When machining a worm-wheel in this way, the diameter of the blank was calculated for the formation of 230 teeth; but, as previously noted, the number of teeth actually cut may exceed this figure, and in the present instance 231 teeth were formed.

The worm-shaft should be mounted exactly at right-angles to the worm-wheel shaft, and the depth of meshing should allow a little backlash to avoid binding.

To allow for taking up wear and for any inaccuracy in locating the two gear-shaft centres, it is advisable to provide a means of adjusting the meshing of the gears. This is, perhaps, most easily done by pivoting the bracket carrying the worm-shaft, so that it can be swung into the correct position and finally locked in place.

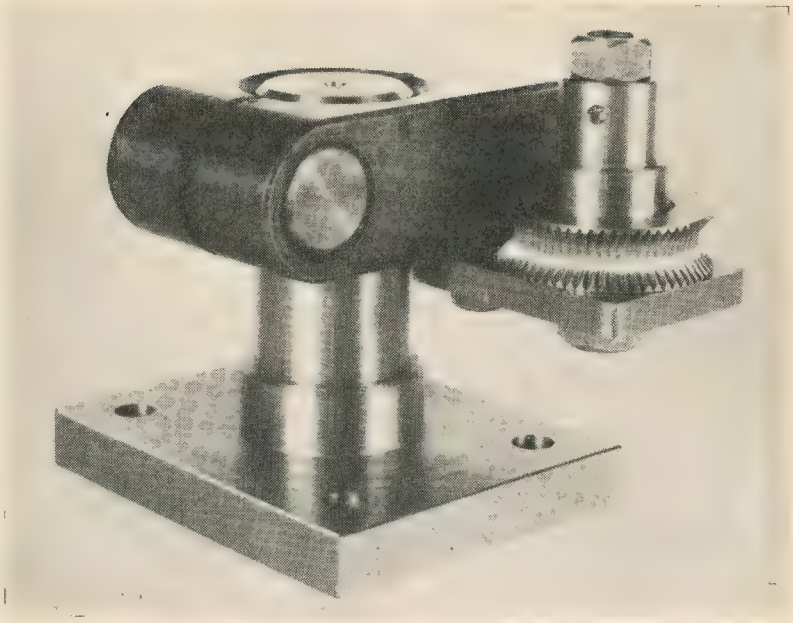


**Fig. 5. A rigid, adjustable attachment for mounting the blank on the cross-slide**

As the worm-shaft usually rotates at high speed, and is also subjected to end-thrust, working friction can be reduced by mounting the shaft in ball-bearings.

The correct alignment of the two shafts is maintained, and continuous lubrication ensured, by mounting the gearing in an oil-tight box, such as that illustrated in the previous article.

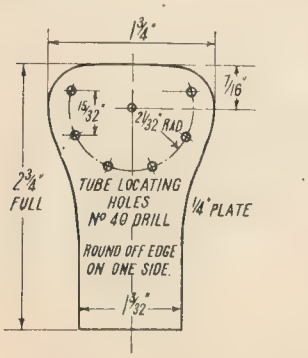
With this form of construction, it is usually possible to fit adjustable housings for the worm-shaft bearings, so that the meshing of the gears can be accurately set.

# L.B.S.C.'s "NETTA"

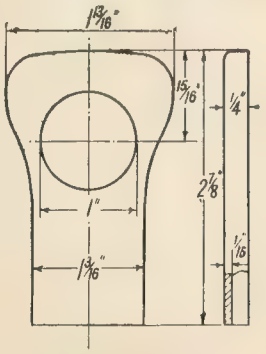
(*Continued from page* 360)

40 drill through the lot, then open out and ream the holes, same as firebox tubeplate, but put the reamer right through, as the tubes should fit easily at this end before expanding. Countersink the holes slightly on both sides, then drill and tap the stay and steampipes holes as shown.

The firebox joints can then be brazed, using the same procedure as for the shell; start at one bottom corner, and work right around. Warning: don't let the blowlamp flame play on the metal between the tube holes for too long, or you've had it; there will be just one big ragged hole, in place of the small ones, in two wags of a dog's tail. When doing the doorplate, run a fillet right around the firehole ring. The firebox can then be stood right way up, in the coke, and the crownstay flanges brazed to the top. After applying flux, lay a strip of coarse-grade silver-solder alongside each, then heat up until it melts and sweats right through, sealing the rivets. Then apply the brazing strip, and run a fillet along each side, opposite to the flange. Opponents of the girder-stay method of supporting the firebox crown, argue that the flanges can be torn away from the crown sheet. I'd dearly love to see them having a try to tear the crown stays off one of my fireboxes! The whole lot forms a box girder, one of the strongest forms of construction known. It was solemnly asserted that only a lunatic would suggest putting a square tube across the Menai Straits and running trains through it; but at the time of writing, the bridge is still carrying the L.M.S. heavy locomotives and rolling-stock, and apparently isn't any the worse for it! All being well, I'll describe the rest of the boiler assembly next week.




**Firebox former**



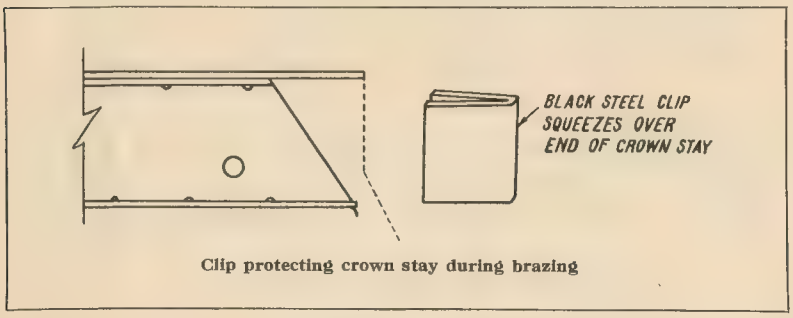

**Firebox doorplate**

# Boiler Making

## SUPPLEMENTARY NOTES ON CONSTRUCTION

By D. J. R. Richards

ANYONE who was rash enough to start bowling slow stuff on a good wicket to Mr. Neil Harvey (Australia) might reasonably expect to go for six; and the writer who leads off on boilers in THE MODEL ENGINEER is in much the same case. In fact, I would not be surprised to find that the good Mr. H. E. White who put himself on to bowl in this game is not still looking for his ball somewhere in the long grass ! Hence the somewhat timorous heading, because I am not going to risk going out " in the middle," but only to talk about a few details.




Clip protecting crown stay during brazing

**Fitting of Boiler Flue-tubes**

To get a nice pressure-tight fillet of silver-solder around the end of the tube where it comes through the firebox tube plate, the tube should come through just under $\frac{1}{16}$ in. into the firebox. If it does not come through far enough, you are very likely to find a pinhole leak when you try the boiler on a low pressure test, and that is not a very pleasant problem. I have just rectified that precise trouble on two tubes by fitting in two tightly-fitting copper ferrules and silver-soldering them from inside the box with an oxy-acetylene blowpipe; but it is not a nice job. Messrs. Johnson Matthey do not recommend using a blowpipe with " Easyflo," and although I have got away with it (because I have no other means of heat) by always making the job and not the flame melt the silver-solder, in this case it is almost impossible. Luckily, the tubes were near the bottom row, and I was able to use conducted heat from the plate to a large extent.

I would suggest to those who find it difficult to get the tube fitting exactly to their liking, that it is worth while screwing the tubes into the tubeplate before silver-soldering them, because this locates them definitely, and the silver-solder works through the threads to make a fillet.

I have spent a lot of time at recent " M.E." Exhibitions, when not hindering, or otherwise annoying the real demonstrators, preparing boilers, which have come up by various channels for brazing, for the Maestro; and I have nearly always found one or two tubes in each assembly which just fell through the tubeplate. This seems to me reasonable proof that a lot of workers do find it difficult to get the fit they ought to get. One extra touch with the reamer, and it is a case of " the little more and how much too much it is." Last year, I watched our demonstrator dealing with a tube which fell through whilst he was actually silver-soldering them in, and I expect those others who were watching thought as I did—rather him than me ! The screwing gets over this trouble. When I first tried it, I found that the thin tubes did not take kindly to the direct application of a die —they were apt to crumple. I got over this by running a 40-t.p.i. chaser over them and then following up with the die. At first I bothered to set up a 40-thread train, but I soon found it wasn't necessary—the chaser lightly applied will start the thread all right.

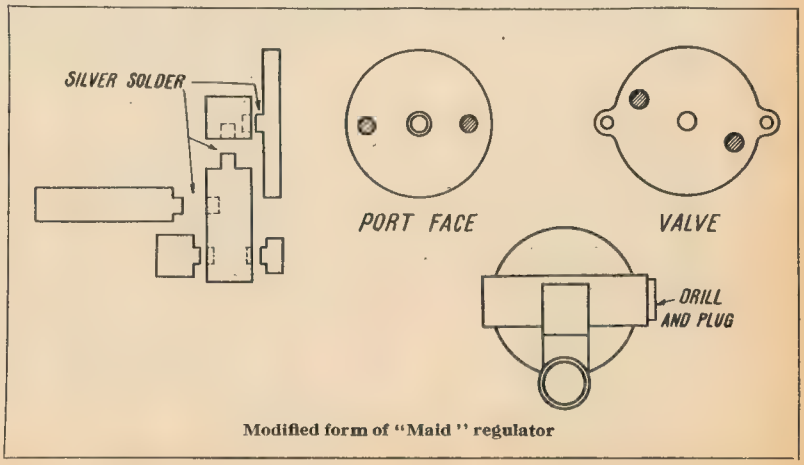
**Fluxing Joints**

Again, both from experience at the Exhibition and from jobs with which friends have asked me to help, I find that somehow the advice repeatedly given in " L.B.S.C.'s " notes just has not penetrated. Well, neither will the brazing medium if you rivet the joint up first, and then put some flux on the outside. I think I found only one firebox assembly out of many last year, on which the joints had been fluxed first, and then riveted. It may be due to an idea (which I too had until I was told otherwise), that the fluxing effect wears off if you leave it any appreciable time before brazing. Actually, no riveted joint being airtight, you are far more likely to get oxidisation if the faces are clean but not fluxed.

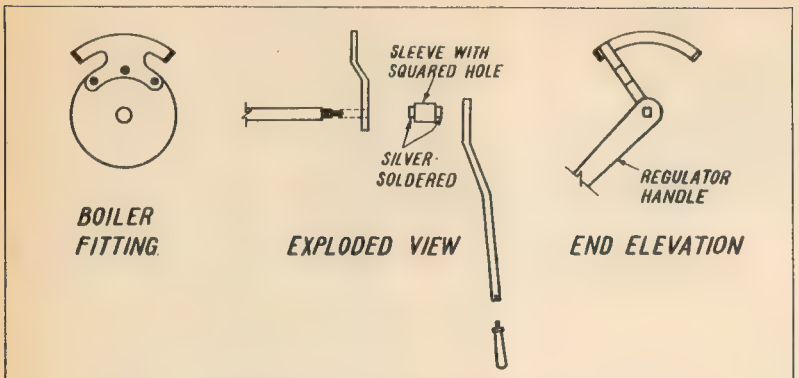
I would make an especial plea to those who may be hoping to get their boilers brazed at this year's exhibition: Please, flux before riveting ! You have no idea how annoyed our demonstrator gets; and when things do not go well, who gets the blame ? I'll give you one guess.

**Two Tricky Operations**

I have only once seen anyone burn a hole in a flat copper plate with oxy-acetylene, and it were kinder not to recall that sad occasion. It is quite another matter when the job involves risk of playing the flame on the edge of a plate. Crown stays are a case in point. You have got to get the heat right along the flange of the plate to ensure a sound joint with the firebox outer sheet, and in withdrawing or applying the flame, a second's careless-




Modified form of "Maid " regulator




**Backhead stop to replace stop-pin on port face**

ness will take a piece out of the end of the stay plate, because the *edge* is exposed to the heat. I consider this one of the most difficult jobs in boiler making, and usually I bring mine up to the exhibition and unload them on our demonstrator, with the suggestion that I am really doing the party a good turn by providing material for his demonstration. But if forced to do them myself, I make a couple of black steel clips to slip over the outer edges of the crown stay, which gives me a good deal more confidence. (N.B. Remove clips after brazing.)

You may find that the boiler design you want to follow, or maybe your own design, calls for tubes located very close to the joint between firebox tubeplate and inner wrapper. Now, you have to get the latter two items hot enough to ensure penetration and a sound joint; and in doing so, it is very easy to burn the edge of one of the very adjacent holes in the tubeplate. This annoying, but not irreparable, misfortune can be avoided by not opening out the outer pilot holes in the tubeplate to full size until after plate and wrapper have been brazed together. You give yourself a much bigger margin for possible error.

**Regulators**

Of all the many designed by our friend "L.B.S.C.", the one he suggested for the *Maid* and the *Minx* is my favourite, because:—(*a*) the action is perfectly balanced; (*b*) it admits of large steam ways, and (*c*) at the same time there is an adequate bearing surface to help it remain steam-tight.

If applied to modern boilers with very squat domes—such as the "Black Stanier"—in the form designed, the lower steam port would come much too close to the water level. I wanted to fit one to a class "5" boiler I am just finishing, and got it in by making the disc with two lugs on the horizontal plane, to take the actuating levers, and arranging the steam ports horizontally instead of one above the other. Both ports are at practically the same height above "sea level" as in the original design, as I pinched a bit by making the inner dome out of 16-g. copper beaten to shape. If—as I did accidentally—you drill the two holes a shade wrong and thus get one port opening before the other, you obtain a very fine "first port" opening equivalent to the "nick" formed on other types. Of course, if you fit this regulator to a Stanier loco, you are in the red with Inspector M.; but then, if he starts undoing nuts to see what is under the dome cover, he himself will be for it with the Worshipful Union of Nut Undoers.

Another design I have found very satisfactory is that described for *Iris the Antidote* several years ago. In the $\frac{3}{4}$-in. scale size, the steam opening, compared with the bore of the pipe, etc., seems reasonable; but when you get down to $2\frac{1}{2}$-in. gauge engines, with big cylinders, the restriction on the size of the regulator tube makes it a ticklish job to combine an adequate steam port with safe bearing surfaces to keep the job steam-tight. I hit this difficulty in rebuilding a "Princess" in this size for a friend. Her four cylinders work out to the equivalent of two 1-in. bore, and my thoughts began to go back several years to the gentleman who used to write of "wiredrawing" the steam. Not being an engineer, I never fathomed what he meant. To the simple military (or "Blimp") mind it merely seemed like preventing the driver opening the regulator more than half-way.

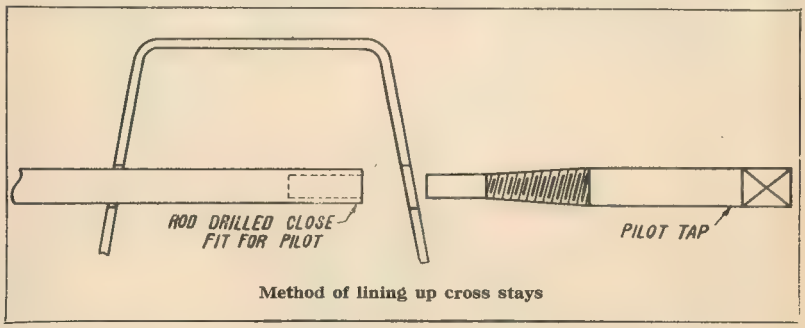
Anyhow, I cut out the stop-pin at the bottom of the valve, and put in a second steam port, thereby doubling the passage area without reducing the bearing surface; and on the backhead flange, I fitted the stop-plate as used in full-size practice. The stop-pin can be screwed on to an extension of the regulator handle with a fine thread, say 60 t.p.i., adjusted to the correct position by blowing with the mouth down the steam pipe, and then removed and silver-soldered in position.

**Firebox Stays**

I would not risk entering into the argument between those who caulk them with soft solder and those who prefer hard-soldering the lot. But as a half-way house, may I humbly endorse the recommendation of another writer, to give Johnson Matthey's "Comsol" a trial. It melts at about double the temperature of "Soft Tommy" and so gives you a bit more safety margin in case you have listened to the voice of the Siren ("It's all right, old man; it's out of sight, over the top nut.") But it also is much easier to apply just where you need it. Whereas "Tommy" either will not run or stick, or else he is apt to run madly all over the place, like a scalded cat, and stick where he is least wanted.

**Alignment of Cross Stays in Belpaire Fireboxes**

Most modern fireboxes taper in two different planes, and it is not easy to make sure that the threads on the stay nuts are correctly aligned. If one goes wrong here, the most likely result is that the threads on the copper stay will tear, exactly what is *not* wanted, since they take the stress whilst the threads on the nut only hold it in position. Of several methods recommended for getting correct alignment, I find the simplest is to use a pilot tap such as are sold for piston-rod glands, combined with a rod of suitable diameter having a hole drilled in one end which should fit fairly tight over the pilot on the tap. If you do not happen to own a commercial one, it is quite easy to make one up from silver-steel, since it need not be a very high-class job, provided that it is good enough to form the beginning of a thread which an ordinary tap will adopt and size. The sketch shows the idea.




**Method of lining up cross stays**


# A SENSITIVE DRILL

By

**B. Terry Aspin**

SOME may have preferred to bore out the upper arm to $\frac{5}{8}$ in. instead of $\frac{7}{8}$ in. thus, relying on the wearing quality of the iron itself. In this case, however, I have inserted bronze bushes (home cast as usual) instead. The spindles themselves are $\frac{5}{8}$ in., turned from $\frac{7}{8}$-in. mild-steel bar, leaving a full diameter collar near the middle, and bored $\frac{3}{8}$ in. The lower part, running in the bush, is slotted to take a key and either end is provided with a flat for a grub-screw. The slotting called for a home-made end-mill $\frac{1}{8}$ in. diameter, and the set up is illustrated in Fig. 16. Mild-steel collars, $1\frac{1}{4}$ in. diameter, fitted with 2-B.A. Allen screws, are provided below the bushes to prevent the spindles lifting. The upper parts of the spindles, of course, carry the cast light alloy step-pulleys, also secured with 2-B.A. grub-screws. The adjustable, depth-stop collars are also described in Fig. 13. They are of mild-steel and were slotted, quite neatly, on the power saw.

Quadrant arms are made from $\frac{1}{8}$ in. thick, bright mild-steel plate, obtained with the ground bar from Kennions. Four blanks were cut off on the hack-saw machine and these, for the time being, were left some half-inch longer than actually required. The first move was to stack them together in the jaws of a machine vice and fly-cut the sides parallel on the vertical-slide. The stack of blanks were then drilled through at both ends, $\frac{1}{4}$ in. clear. One of these holes was, of course, required for the pivot-bolts, but the other was simply a means of mounting the blanks, *en bloc*, by means of T-bolts, to the vertical-slide again for end-milling the slots. The T-slot in the slide took care of the cutter breaking through (Fig. 17). With the milling completed, the extra drilled length was sawn off and the ends filed to a neat radius.

The ball-handled clamp-nuts for the quadrant and the headstock cotter are similar, but of different dimensions. They were turned from stock, $\frac{5}{8}$ in. and $\frac{3}{4}$ in. respectively, by manipulation of the slide-rest to rough them, then a final cut taken with a hand tool. For facing and drilling the nut for tapping, the larger end of each, using a strip of aluminium for protection, was gripped in the self-centring chuck with the lever at the required angle (Fig. 18). They were completed by polishing.

It will be obvious, from the drawings, that there is a possibility of the clamp-nut on the quadrant being tightened in such a position as to foul the adjacent jockey pulley. A choice of two tightening positions, however, is obtained by filing flats under the head of the clamping-bolt so that it fits into the slot on that side of the quadrant. Thus the bolt is held against rotation and the nut can be arranged to tighten away from the pulley.

**Back to the Beginning**

Now, with two nice little headstock assemblies to encourage me, I turned my attention to making the final draw-

*Continued from page* 323, *March* 24, 1955.

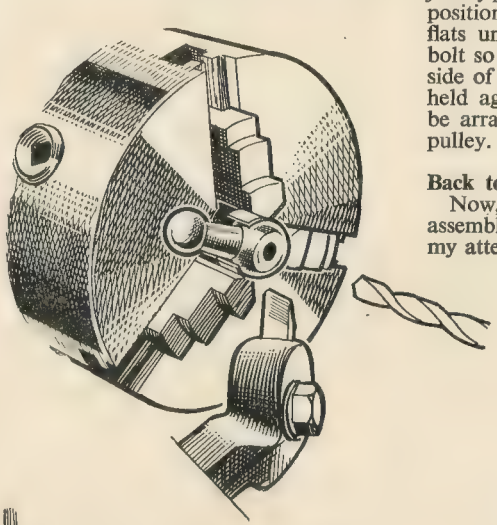
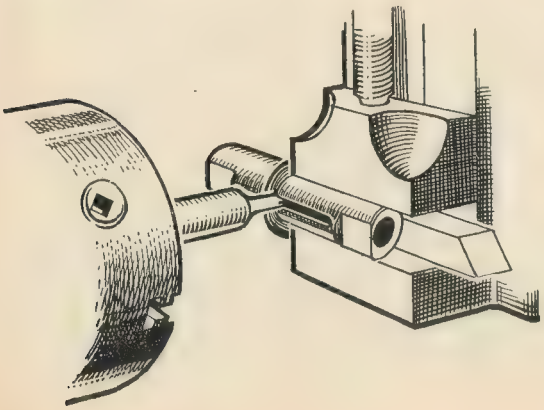
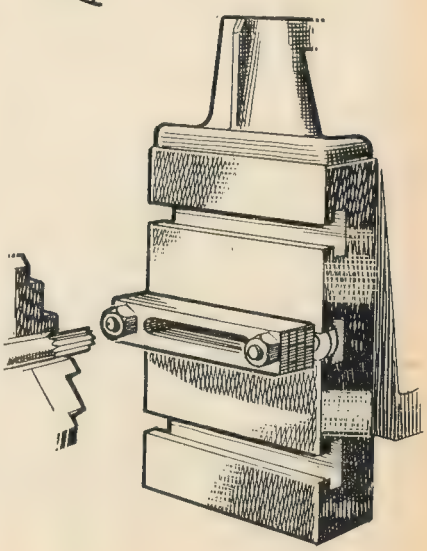


**Fig. 18. Facing and boring the wing-nuts**



**Left: Fig. 16. Milling the keyway and flats on the hollow pulley spindle**



**Right: Fig. 17. Slotting the quadrants in a stack**

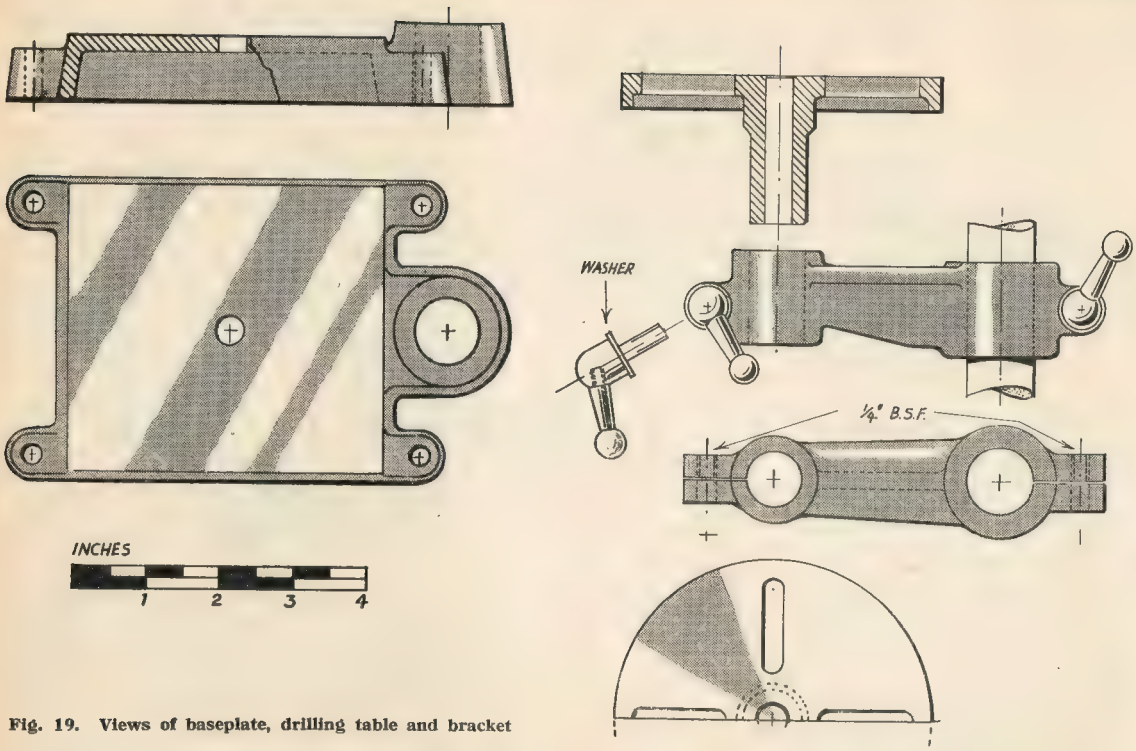


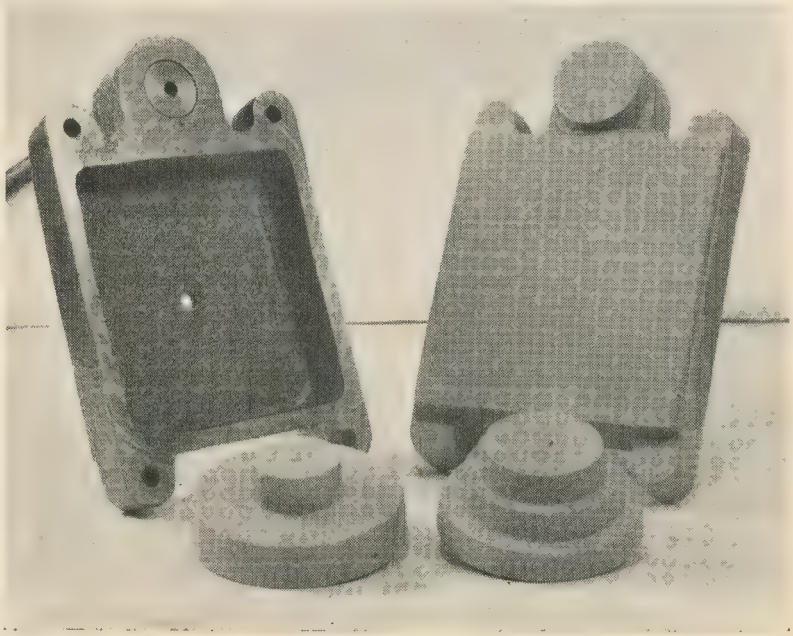

**Fig. 19. Views of baseplate, drilling table and bracket**

ings for the remaining components; baseplate casting, drilling table and bracket. There is nothing spectacular about these, of course, but they are of ample sturdiness for the duty expected of them. The baseplate is of box section with four pads for holding-down bolts and a raised boss for the pillar. Drawings for this, along with the other items, are shown in Fig. 19. Fig. 20 illustrates my method of making the baseplate pattern.

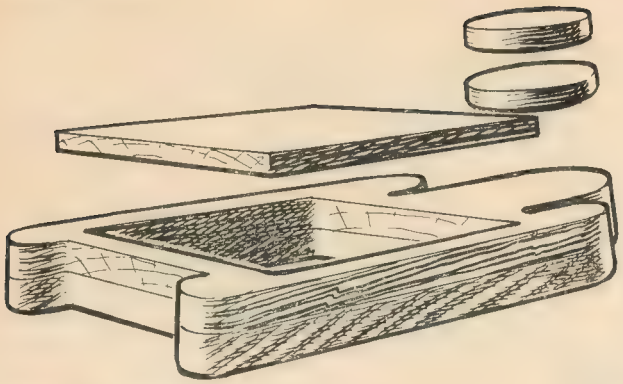
At first sight it might appear that the best way of making a box section is, simply, as a box; four sides and a top. This, of course, is as it may be but, with a fretwork machine as No. 1 carpentry tool, it was not *my* way. Instead, two pieces of wood were selected which, together, had a thickness equal to the depth of the hollow, underside. From these the plan view was cut out, with the saw table on the skew to give a small angle to the sides for draught. A third piece, cut to the appropriate rectangle, was pinned and glued in place to form the bed, and additional height given to the column boss by a couple of extra circular laminations.

With regard to the drilling table bracket, it is felt that the illustration (Fig. 21) will give a better idea of the pattern construction than a volume of literature. My reason for giving such detail of the patternmaking is motivated by the memory of my own early difficulties—not that I claim to have overcome them all by any means! Here, again, construction is based upon the plan outline and not, as may first seem obvious, as two vertical cylinders joined by a web. Both solid sections are given a slight taper, inwards from top to bottom, to help in clearing the mould.

The circular table itself is simply a small faceplate pattern with an extended central boss or stem on the underside. This is turned to a spigot in the final machining, to fit the socket in the bracket. It has four radial slots and takes the form of a wooden disc with a cut-out ring glued and pinned to the edge underneath. The stem is also built up from laminations and the whole, bonded in the usual way, was nutted up tightly on a ¼-in. bolt for

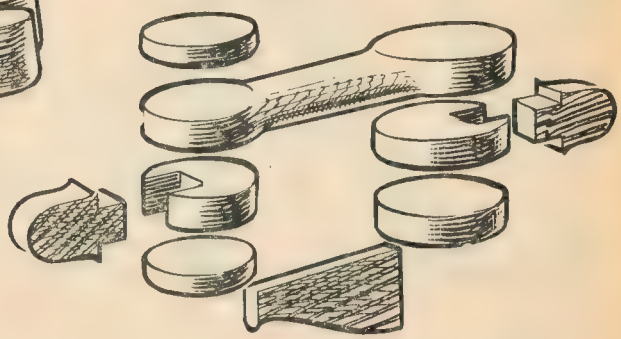


**Photograph No. 6 Baseplate with pattern and pulley patterns**



Left: Fig. 20. Construction of pattern for baseplate

Below: Fig. 21. Another "explosion." This time the arm or bracket



turning. In actual fact, with both lathes otherwise occupied at the time, I used my portable electric drill for wood "turning" and found it most effective. With packing underneath to adjust the height, it was secured to the bench top with a large clamp. A spare hand-rest was likewise clamped, by its soleplate, in the appropriate position and away we went! Finally, the bolt was exchanged for a length of ¼-in. wood dowel, which had been smeared with glue before inserting.

Patterns for the pulleys were also required. On my shelf there were no less than four 3-step pulley patterns, ranging from Super Adept ¼ in. section belt to M.L.4 A section belt, in easy stages. Now there are five! I wasn't

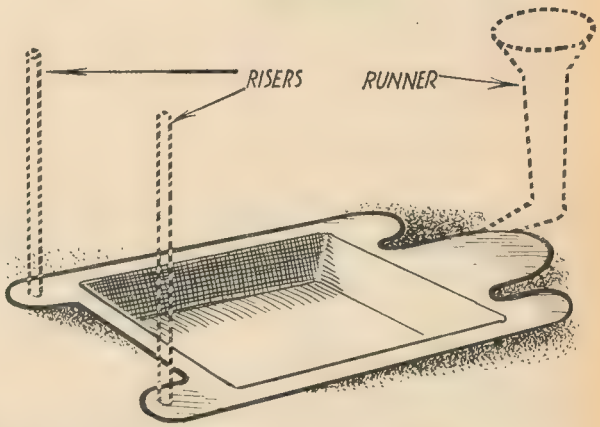
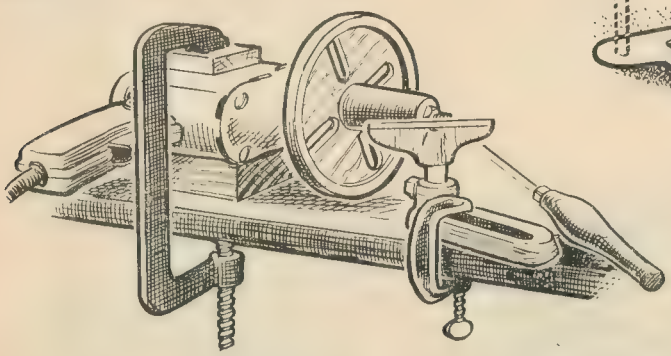



Fig. 23. Moulding the baseplate, showing positions of runner and risers



Left: Fig. 22. Bench lathe, indeed!

lucky enough to find a pattern suitable for the jockey pulleys, either, so I had to make one of those also. Both patterns were produced in a manner similar to that employed for the drilling table and on the same "lathe."

There is very little to be said about the moulding of the baseplate. It is one of those rare jobs that is straight in—straight out, no fiddling—no fettling.

The pattern embedded in the drag was, of course, bottom uppermost and no doubt it helped, in withdrawing the cope, that I had well dusted the recess with parting powder, brushing it well into the corners to avoid any possibility of the sand clogging. Ingating was to the large boss, with a couple of risers from the remote corners to release the gases from the thinner section (Fig. 23).

*(To be continued)*

## Next Week . . .

**FLASH STEAM**
A well-known experimenter, Mr. J. A. Bamford, describes recent experiments with steam-driven racing model boats.

**LATHE ACCESSORIES**
The construction of an adjustable offset tailstock centre, by "Duplex."

**"TWIN SISTERS"**
Details of blower valve, sanding gear and the making of realistic cab windows.

**PETROL ENGINES**
Further machining instructions for the components of the 10 c.c. o.h.v. four-stroke engine.

**MODEL POWER BOATS**
"Meridian" reports on recent activities in the U.S.A. and Canada, with photographs of some interesting boats.

**5-in. GAUGE ELECTRIC LOCO**
A description of the construction of a nice-looking electric locomotive which has proved itself to be a powerful passenger-hauler.

**"NETTA"**
Assembling the boiler for the 2½-in. gauge engine.

# NEW APPLICATIONS OF BOTTLED GAS

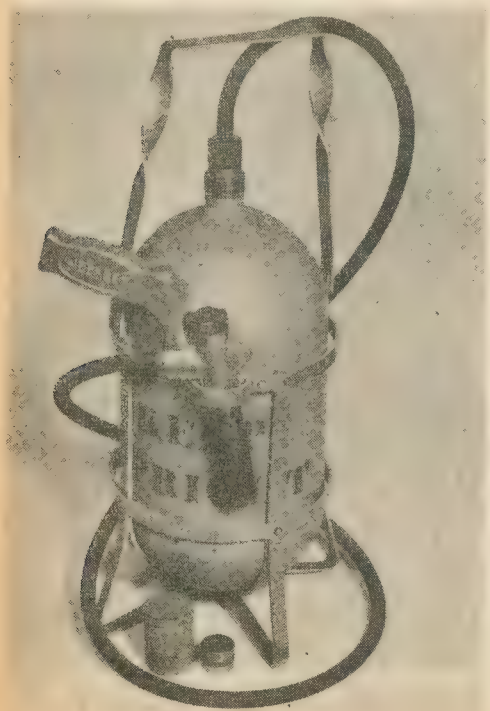
THE use of hydrocarbon gases, liquefied under pressure and supplied in metal cylinders and pressure vessels, is now very popular not only for domestic lighting and cooking where coal gas is not available, but also in various industrial applications, where it may offer practical advantages over mains supply, such as high calorific value, and the ability to produce high intensity of heat without forced draught, quite apart from convenience and portability. The gases employed include butane and propane, and mixtures of these gases with other coal or petroleum derivatives.

We have in past volumes of THE MODEL ENGINEER given some information on the use of these gases, and reviewed burners of various types which are specially designed to utilise them. It has occurred to us that there is a field of application for them not only for heating purposes in the model workshop, but also for firing small boilers in mobile models such as power boats, locomotives, etc. Most supplies of bottled gas are obtainable only in containers too large to be accommodated within permissible limits of bulk and weight for this purpose, but within recent years, small containers have been marketed by Dex Industries Ltd., Wee-dex Works. Twickenham, Middlesex, and through their co-operation, we have been able to test out the appliances for which these are designed.

The small Wee-dex containers available include the 1 lb. cylindrical bottles employed for a miniature cooker or picnic stove, and a bulbous container of the same capacity for use with a blowlamp burner, which has already been described in these pages. The former container, however, is the most convenient size for use in portable models, and can be used either in the vertical or horizontal position, provided that in the latter case an internal collector pipe is fitted to ensure that the gas is taken from the highest level in the container, as for the small bunsen burner illustrated. If this precaution is not observed, liquid gas may get into the jet of the burner and cause temporary choking. In many cases the container can be used in an oblique position, and thus avoid the need for the internal collector.

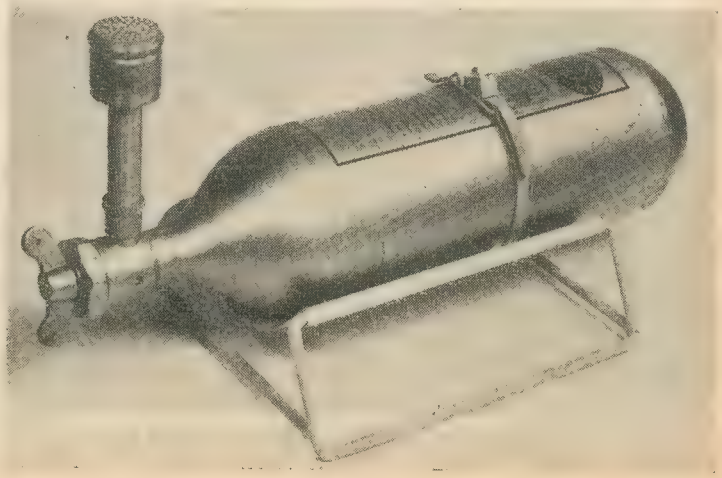
The normal blowlamp burner is suitable for firing some types of small boilers, including the popular internal-flue marine type; in other cases, the cooker type of burner is preferable, such as for boilers which have a fair amount of firebox space below the generating tubes or drums. In the case of the boiler which has been successfully used in the "M.E." workshops for testing and demonstration purposes, a burner of the cooker type was adapted by fixing it to a base flange in the bottom of the firebox, and connecting it by a short capillary tube to the control valve fitted outside the casing. A flexible pressure pipe extension with union joints was used to connect it to the container. All the Dex containers are fitted with self-sealing valves so that no gas is lost in connecting and disconnecting, and the burners are designed so that they can be connected to the container without the need for interposing a pressure reducing-valve.

**The self-contained miniature blowlamp**



**Left: The 5 lb. container, with flexible tube and torch burner**

**Below: A bunsen-type burner, fitted to the 1 lb. container with internal siphon tube**



# QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

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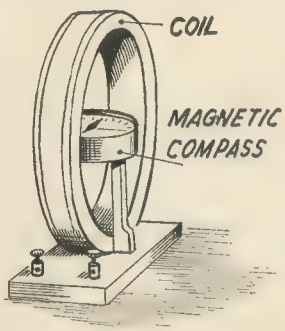
**Sensitive Galvanometer**

*I wish to construct a sensitive galvanometer, but have been unable to find any books or other information dealing with this subject. Can you please give me the essential basic details of this apparatus and suggest how to make it as sensitive as possible?*

H.L.H. (Grays).

We regret that we cannot refer you to any definite information on this subject at the present time, though it was often dealt with in early volumes of THE MODEL ENGINEER, and it was also dealt with in our handbook "Electrical Measuring Instruments" published very many years ago, but this is unfortunately out of print.




Basically, the principle on which the standard form of galvanometer works is extremely simple, and depends on the tendency of a magnetic needle to turn at right-angles to a conductor carrying electric current. The usual form of galvanometer consists of a flattened coil of wire with a pivoted magnetic needle either inside the coil or on the outside in as close proximity as possible.

Various sizes of wire and numbers of turns are used, according to whether the instrument is to deal with high or low current and potential, and for certain purposes, a mirror is fitted to the magnetic needle so that it can be used to reflect a ray of light on to a large scale, so as to detect the very slightest amount of movement.

We may add that for practical purposes, the modern moving-coil instrument has largely superseded the older types of galvanometer, as a single instrument can be used in conjunction with resistances, either in series or parallel, to cover a very wide range of current and voltage measurement.

**Self Lubricating Bearings**

*Where can I obtain "Oilite" or other oil-retaining bearing bushings? Also, please advise me whether there are any difficulties in machining these or similar special bearing materials, some of which, I understand, contain graphite in the pores of the metal, which might possibly dull the edges of tools, particularly reamers.*

J.H. (Liverpool, 7).

"Oilite" is manufactured by the Manganese Bronze Co. Ltd., of Ipswich; London address: 63, Grosvenor Street, London, W.1, and can be obtained as finished bushes in a wide range of sizes, but it can also be obtained in solid or hollow rods. Other oil-retaining bearings can be obtained from the Morgan Crucible Co. Ltd., 52, Battersea Church Road, London, S.W.11.

These materials can be machined without any very great difficulty, but they are extremely fragile, and special care is required in chucking, etc.

"Oilite" consists simply of oil-impregnated sintered bronze, but Morganite contains graphite, which does not affect the machining to any great extent, as the lubricating quality of the graphite avoids the tendency to dull the edge of the tool. The use of reamers is open to objection, as there may be a tendency to burst the bushes, and a better method is to burnish the interior surfaces of the bushes after they have been inserted in the housings

**Painting a Model Steamer**

*Could you please let me know what paint to use for my static model of the motor coaster P.B.7 "Karrier." I would like to know the best make of paint suitable, how many coats to put on of each paint, and what colours the hull, superstructure, funnel, etc., should be painted, as no details are given as to painting on the plans.*

*Also, I would be glad if you could let me know what is the best material to use for flags; also, the best thing to use for rigging, ropes, etc.*

K.B.H. (Farington, Lancs).

It is impossible to state what is the best make of paint to use for a model boat, as most of the well-known brands are quite suitable. The usual procedure is to apply a first coat of "filler" or "priming" paint and to follow with a number of coats, rubbing down between each one until the final coat is reached. A small model, or a model not intended for sailing purposes, does not need so many coats.

The colour scheme of a ship varies from one company to another and the funnels are usually quite distinctive. Our plan P.B.7 represents a typical coaster and the colour scheme could be made to suit the builder's taste. The most usual colour for a ship of this type is black hull, red underwater body and white superstructure. The funnel may be buff or could be red with a black top.

Masts are usually painted buff or stone colour. Rigging should be of good quality cord such as may be purchased from a dealer in fishing tackle. Flags should be of silk, linen or calico, but should not be too stiff.

**Rotary Blower**

*I have purchased an ex-W.D. sliding vane blower for fitting in place of bellows to a forge for melting metals. What is the minimum size electric motor required to run this? Is there any lubrication needed?*

*I was advised by a friend to fit a drip feed over the intake tube, which I did, giving one drip every 30 seconds, but when running, oil seems to blow out everywhere on the outlet side, so am wondering if it is needed at all.*

A.T.C. (Dover).

We suggest that you use an electric motor of not less than ¼ h.p.

It must be realised that you are using the blower for a purpose for which it was not designed. In aircraft use, it was copiously lubricated, and an oil trap was fitted to the outlet side of the pump. A suitable oil trap is available from K. McGrath, 244, Marton Road, Middlesbrough.

You may be interested in an article published in the May 6th, 1954 issue of THE MODEL ENGINEER entitled "A Rotary Air Compressor Plant" with details of oil trap and lubricator, by Mr. T. W. Attwater.

**Stainless-steel Tubing**

*Could you please give me the name of suppliers of stainless-steel tubing in lengths suitable for flash steam boilers?*

D.E.W. (Hever).

We suggest that you enquire of the following firm: Le Bas Tube Co. Ltd., City Wall House, 129, Finsbury Pavement, London, E.C.2.

**Meco Spray Gun**

*Please can you tell me of the name and address of the firm that make the Meco Spray Gun?*

J.C. (Sutton-in-Ashfield).

The makers are: Meco Spray Gun Co. Ltd., 30, Lower Richmond Road, Putney, London, S.W.15. Telephone: PUTney 9708.

# READERS' LETTERS

**Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

### THE LAXEY WHEEL

DEAR SIR,—I have been very interested in the letters referring to the Laxey Wheel.

I have always been given to understand that my great-grandfather, Martin Bowden, a Cornishman from Camborne, who travelled the world erecting engines, as did his son after him, put up the Laxey Wheel.

My grandfather, Martin Teague Trewheeler Bowden, was born at Laxey in a house in the vicinity of the wheel in the period when the wheel was built, and no doubt if an I.O.M. model engineer consulted the register of births in that district, he would find this to be so.

One day I hope to pay a visit to the I.O.M. to see this great wheel, for which I feel a family affection.

Yours faithfully,

MARTIN WILLIAM BOWDEN STOREY.

Newton Abbot.

DEAR SIR,—In reply to readers' letters on this subject, I bought an official post card while on holiday in Laxey last year, and what an interesting place it is! The dimensions of the wheel are as follows :—

Circumference, 228 ft.
Diameter, 72½ ft.
Breadth, 6 ft.
Drawing Strength, 200 h.p.
Revolutions, 2½ per minute.

Hauls 250 gallons of water from a depth of 1,800 ft. each revolution.

There are 192 buckets on the wheel, each capable of holding 20 gallons.

The axle has a length of 17 ft. and a diameter of 21 in., and weighs 10 tons.

Yours faithfully,

Manchester. "INTERESTED READER."

### LATHE BEARINGS

DEAR SIR,—I thank both Mr. Nicholas and Mr. Latta for the interesting information they have put forward.

Mr. Latta's description of the Milnes mandrel being coned out at the front end from 1¼ in. to 2¼ in. clears the matter, but the drawing does not seem to show that the coned portion belonged to the mandrel, but rather to the outside of the bearing, hence my writing. It may be that. Mr. Latta's Drummond was the early round belt overarm headstock job that came out about 1912—of course, there is no comparison between that machine and the latest "M" type. To progress from 3½ in. to 3¾ in., one naturally would see a difference in performance, which is equal to my view that the "M" type Drummond is a "very strong" lathe compared with lighter 3½ in. machines.

This extra strength can be seen in the backgear wheels and change gears with their broader faces and larger teeth, slide feed screws ½ in. diameter as against ⅜ in. found elsewhere. The 1 in. diameter mandrel has a smaller hole running through it than that of the more usual 1¼-in. spindle, so the stiffness here should be about equal.

I should imagine that a heavy 90-100 lb. flywheel, plus a good clinging 1in. flat belt, is a more powerful prime mover than a 1/3 h.p. motor.

Just after the first war, Drummonds turned out a treadle-driven 6-in. centre lathe for use in outlandish places—so there must be power in a good pair of legs after all.

Yours faithfully,

Cardiff. "NOVICE."

### RAILWAY ELECTRIFICATION

DEAR SIR,—In "Smoke Rings" in THE MODEL ENGINEER of February 10th, you say you have already had several readers write that the efficiency of modern generating stations and electric locos is 25 and 90 per cent. respectively. Doubtless by now these good gentlemen have reiterated their figures!

The important thing, of course, is to state precisely what is included in the efficiency figure. You do this admirably in your Editorial, but the source of the figures appears to be suspect or the figures are for exceedingly antique plant.

Taking the B.E.A. report for 1953/1954, page 47 states that "Thermal efficiency of generation is the ratio expressed as a percentage of *a* the amount of heat energy equivalent to electricity sent out from the power station to *b* the amount of heat energy in the fuel consumed in generation. That is taking into account all heat, mechanical and electrical losses between burning the coal and the feed to the transmission lines. The *average* overall efficiency (as defined above) for *all* the Electriciy Authority's power stations for 1954 was 23.4 per cent. The best were above 30 per cent. and about 2.6 per cent. (of the country's power output) were below 10 per cent. efficiency.

Using approximately your own remaining figures—say 23 per cent. of the heat energy in the fuel goes to the transmission line. The step down transformers, rectifiers and d.c. transmission reduce this to say 20 per cent. at the traction motor. The motors and locomotive in friction, etc., lose a further 2 per cent. leaving 18 per cent. as available drawbar energy (not 4 per cent.).

Perhaps someone would venture a figure for the steam locomotive of the ratio coal burnt during traction to total coal burnt in a given time. I suspect this further drastically reduces the 7 per cent. efficiency quoted.

I put the above, not to belittle the performance or charm of the steam locomotive, but to correct any wrong impression which may have been given.

Yours faithfully,

Rugby. A. J. WAINSCOT, B.Sc.(ENG.).

### AVELING ENGINE NO. 2888

DEAR SIR,—May I be allowed a little of your valuable space to reply to, R.J.W. with regard to my statement about Aveling Engine No. 2888, it was quite correct. It always struck me as so remarkable that it should be No. 2888 and year 1888. I well remember it, as I was the only person to drive it on the road after 1936.

Whilst on this subject of engine numbers I would like to point out that they can be somewhat misleading, and one can only estimate the age of an engine to within a year or two unless one has access to the maker's record-book. In the old days when a good deal of buying and selling of engines was taking place it was not uncommon to find that some of the dates on the chest plates had been tampered with. The writer has come across one or two instances of this. Also it was the custom of some makers in those days when a fair number of engines were being built, to build a fair number of boilers for stock, not all of the same type. These boilers were given their numbers in the boiler shop and that was the number of the engine when it left the works. Thus it follows that when a batch of boilers were put in store, the lowest number may be given to a boiler for a haulage engine and the highest number to a boiler for an agricultural engine. An order may then be placed by a customer for an agricultural engine; well then, this boiler is taken out of stock and the engine built and delivered, whilst the boiler for the haulage engine, still remained in stock until an order was placed for it. Sometimes this may be 12 months after, but those engines still carry the number which was given to them in the boiler shop. I myself have come across a number of engines to which this has happened, while looking through the record book, of a well-known make of engine, which proves what I say, that one cannot always give the exact age of an engine by its number.

Trusting that this may throw some light on the matter of engine numbers.

Yours faithfully,

Liversedge, Yorks. J. A. SMITH.

### DRUMMOND 4-in. LATHE

DEAR SIR,—With reference to Queries and Replies in the issue of THE MODEL ENGINEER dated February 24th, 1955, on the above subject, I have one of these lathes, manufactured in 1910 and the slide plate and leadscrew nut are separate. The leadscrew nut is of brass, and is screwed into the slide plate; the only way to dismantle and get this out, is by taking off the headstock casting and bringing the slide plate and leadscrew nut forward and out into a slot which is cut out in the round bed. I tried to dismantle mine from the tailstock end, but it would not come out, so I had to to dismantle the headstock.

Yours faithfully,

Cubert. P. PASCOE.

### FACTS AND FIGURES

DEAR SIR,—It would mislead your readers as to the nature of mathematics if Mr. Westbury's remarks (Facts and Figures, February 17th) were allowed to pass unchallenged. In his second paragraph the impression is given that in the research establishments of industry data are obtained experimentally, are correlated and reduced to a simple equation ($y = 4 \times 3$). While this may be true of statistical analysis it is not true generally. The process is to derive an equation of a more or less complex type depending on certain well defined, but reasonable assumptions based on fundamental principles and previous experience, and having derived the equation, to devise an experiment to justify it and establish that the assumptions were in fact reasonable.

It was by such a process that radio waves were discovered (contrary to Mr. Westbury's statement); for Clerk Maxwell assumed certain properties of space and derived from these assumptions his celebrated electromagnetic wave equations, which indicated the existence of what we now know as radio waves. It was not until ten years later that Hertz demonstrated their existence, experimentally. Similarly Sadi Carnot devised the heat cycle named after him. While no engine is made which works on Carnot's cycle (at least directly) the cycle has given us considerable insight into the workings of heat engines and insight into many other physical phenomena. There are also many mathematical abstractions, such as the stream function in fluid dynamics or entropy in thermo dynamics, which are difficult to comprehend physically but are invaluable to the practical engineer since they simplify (not complicate) his calculations.

Regarding mathematics as applied to model engineering, surely there are many cases where it can be applied as it is in full scale engineering, but there appears to be a school of thought in the model engineering world which says "Ah ! But when things are small it's different, so your equations don't apply." Here are several examples where the principles remain unaltered:—

(*a*) The geometric construction for designing Walschaerts valve gear.
(*b*) Stress calculations in turbine discs or shafts, etc.
(*c*) Design of steam turbine nozzles

and so on: there are many more. Surely where an analysis exists to solve a problem and the model engineer knows how to use and apply it, it is better to do so and work in semi-light rather than total darkness.

Finally, the fact that the stock of the mathematician stands very low (according to Mr. Westbury) is I think, not the fault or inability of the mathematician but rather it is due to ignorance of the nature of mathematics. Oliver Heaviside expressed this better than I can hope to; he said:—

"There are men of a certain type of mind who are never wearied with gibing at mathematics, mathematicians and at mathematical methods of inquiry. It goes almost without saying that these men have themselves little mathematical bent. I believe this to be a general fact but, as a fact, it does not explain very well their attitude towards mathematicians. The reason seems deeper. How does it come about for instance that they are themselves so transparently ignorant of the real nature, meaning, and effects of mathematical investigation, yet they lay down the law in the most confident and self satisfied manner telling the mathematician what the nature of his work is (or rather, is not) and of its erroneousness and inutility, and so forth ? It is quite as if they knew all about it."

Yours faithfully,

Heston. JOHN G. STEEL.

### FLASH STEAM

DEAR SIR,—More power to the elbow of Meridian and his articles on Flash Steam, but disappointed am I, has he never heard of coal ! the solution to blow-lamp troubles !

Ever since World War I and maybe a few years before, I have followed the joys and sorrows of flash steam tyros, but never to my recollection have I seen any mention of coal fired flash steam boilers. I will hazard a guess that the celebrated boatman of the nether regions uses flash steam to transport his passengers over the Styx, and I hazard another guess that he's not bothered with blowlamps for raising steam.

Yours faithfully,

London, S.W.7. "SMOKY."

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# Who's Who IN MODEL ENGINEERING

## A. E. BOWYER-LOWE

No less than 57 years ago, when the first issue of *The Model Engineer* was published, one of its most enthusiastic readers was Mr. A. E. Bowyer-Lowe, then a boy of 14, and this marked the beginning of a career in which a love of all things mechanical was an outstanding feature. This took shape in a wide variety of interests, both as a professional engineer and an amateur model maker, the best known examples of his activity in the latter capacity being in toolmaking and horological work, though he has also had a keen interest in locomotives and has built among others, a ¾-in. scale "Green Arrow."

He was born in 1884, and educated at Newport School, Leyton, and later at Leyton Technical Institute. Long before he obtained his first lathe, a 4-in. round bed Drummond, in 1909, he had built many simple models and pieces of apparatus, such as a Wheatstone Bridge, galvanometers, etc. In his chosen profession of consulting engineer he has been associated with pioneer work in many important modern developments, including the radio industry. His horological work includes the construction of two Shortt free-pendulum clocks, a "Eureka" clock and a simplified Hipp clock, the two latter having won awards at M.E. exhibitions. Other items exhibited include dividing heads, one of which gained a silver medal, and vertical milling attachments.

He was secretary of the Letchworth Model Engineering Society in its early days, but though holding no official position in clubs at present, he is a friend of many societies and is well-known as the donor of the Bowyer-Lowe Cup for the encouragement of toolmaking.

# WITH THE CLUBS

### Harrow and Wembley S.M.E.

On February 23rd at the society's headquarter, Heathfield School, College Road, Harrow, members were shown a 50 min. film on cemented carbide tipped tools, followed by a talk by Mr. Moody of Messrs. Prolite Ltd., the wide application of these tools in industry was clearly demonstrated and the many questions Mr. Moody answered showed that they have their place in the model engineer's workshop.

*Future Arrangements*—

April 10th.—Opening of season at locomotive track, L.M.R. Sports Ground, Headstone Lane, Harrow.

April 13th.—Talk by Mr. L. Coles on Australian Railways, illustrated by slides.

April 27th.—Film Show: Five sound films including, "Introduction to the Heat Engine," "The Fell Locomotive," and films by the Carborundum Co.

Hon. Secretary: K. D. CARTER, "Hedgeley", South Approach, Moor Park, Northwood, Middx.

### Eltham & District Locomotive Society

The next meeting will take place at the Beehive Hotel, Eltham, on Thursday, April 7th, at 8.0 p.m. It is the annual general meeting, and it is hoped that all members will make a special effort to attend. One item to be arranged is the trial run of the chairman's (Mr. Hutton) locomotive. It is hoped to take a film of this occasion at the permanent track at Avery Hill Road, Eltham.

At the last meeting the vice-chairman Mr. A. Brock gave his film show, which was made possible through the courtesy of Mr. Overton in providing transport for the gear. This was a very interesting evening, the film depicting past track events, and during the session, photographs brought along by members were passed around. The society has several track runs booked for the coming season, and members are specially asked to make a list of the dates.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, S.E.9.

### The Gauge "1" Model Railway Association

The association will again provide an exhibit at the Model Railway Club Exhibition at Central Hall, Westminster, April 12th-16th. L.C.C. regulations make it impracticable to run steam locomotives on our working layout, but it is expected that some of our members' efforts in this field will be shown on the static display stand; it is hoped to provide something of interest to steam fans who visit the exhibition.

The electrically-operated working layout will be very similar to last year's track, which was fully interlocked, and operated in the correct manner with the use of bells between the operators.

The association exists to encourage Gauge "1" modelling in all its aspects, and enthusiasts visiting the exhibition are invited to contact the hon. secretary or any of the stand stewards. Members are reminded that a visitors and members book is kept on the stand throughout the exhibition.

Hon. Secretary: J. T. van RIEMSDIJK, 40, Bancroft Avenue, London, N.2.

### York City & District S.M.E.

Meetings to be held in the Rechabite Building, Clifford Street, York, during April: 2nd, 7.0 p.m. Talk and discussion, "Loco. Draught Arrangement." 16th, 7.0 p.m., models night. 30th, 7.0 p.m. Business and a general natter.

Track meetings at Bishopthorpe will be held on April 8th-10th and 24th from 2.30 p.m., visitors will be welcome.

Hon. Secretary: W. SHEARMAN, 28, Terry Street, York.

### North London S.M.E.

Nearly a hundred guests and members attended the N.L.S.M.E. annual dinner and dance, held at the Oakwood Sports Club Hall. Mr. E. Stace, president of the society, and Mrs. Stace were present and representatives of the St. Albans and Harrow Societies were among the guests.

The March meeting of the society saw another annual event, the Jumble Sale; once treasured possessions were sold for perhaps very little although one man's junk was often found to be another's desire. No doubt some members' wives were pleased to see the last of that "thing" which had been "cluttering up," etc., but someone had bought it; and his homecoming may not have been so welcome!

Next meeting 8.0 p.m., April 1st. Subject, "Stained Glass Work," by Mr. Luxford. This meeting will be held by courtesy of the Eastern Gas Board at their offices in Station Road, New Barnet.

Hon. Secretary: W. W. RANSOM, 6; Arundel Court, 127, Woodhouse Road, N.12.

### The Wakefield S.M.E.E.

Meetings are held at the R.A.F.A. Club headquarters, Old Black Swan, off Silver Street, Wakefield, at 7.30 p.m. Visitors are welcome.

April 13th.—Ordinary meeting and "Bits and Pieces" night.

April 27th.—"Trunk Conveyor," the latest film produced by Messrs. Richard Sutcliffe Ltd., Mechanical Handling Engineers, Horbury.

The Wakefield Rotary Club are organising an exhibition of hobbies; the society has been pleased to accept the invitation to co-operate. The exhibition will be in the Wakefield Technical College on June 2nd, 3rd and 4th, 1955.

Preliminary arrangements are going ahead for the staging of an exhibition in late October this year.

Hon. Secretary: J. WARD, c/o 46, Elmwood Grove, Horbury.

### Worcester & District M.E.S.

Our summer programme of track running will be as follows: For public running—Sundays, April 16th, May 21st. Saturday, June 17th, and Sunday, June 18th, will be a week-end rally which we hope will be attended by member clubs of the West Midlands Federation. Subsequent dates will be: July 16th; August 20th; September 17th; October 15th.

It is hoped that on all the above dates visitors will be prepared to do some passenger-hauling.

The track will be open on all other days to visitors from other clubs, and we shall be pleased to see any of them at any time, provided that prior application is made to the secretary.

Hon. Secretary: F. L. FUDGER, 23, Camp Hill Road, Battenhall, Worcester.

### The Junior Institution of Engineers

Friday, April 1st, at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Film evening. By kind permission of the National Coal Board, the following films will be shown: (1) "The Miner;" (2) "Plan for Coal"; (3) "The Scraper Box"; and (4) "Coalmining Today" to be introduced by Mr. Lambton Wilkinson (Public Relations Officer).

Midland Section: Wednesday, April 6th, at 7.0 p.m. at the James Watt Memorial Institute, Great Charles Street, Birmingham. Combined Meeting with Newcomen Society—"Machine Tools—Historical Development—Future Trends."

Friday, April 15th, at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Ordinary meeting—Paper: "The Design of, Materials Used In and The Manufacture of Pick Steels for Pneumatic Picks," by C. Hutchinson (Associate Member and Durham Bursar).

Sheffield and District Section. Monday, April 18th, at 7.30 p.m. at Livesey Clegg House (opposite Union Street Cinema), Sheffield. Ordinary meeting: Paper—"The Organisation of an Engineering Company," by F. Sargeant, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E. (senior partner, Urwick, Orr & Partners Ltd.).

Friday, April 22nd at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Informal meeting. Paper—"Electronic Computers in London: Some Uses and Prospects," by W. J. Kease (member and Durham Bursar

### The Blackpool S.M.E.

The annual general meeting has been held recently, and the officers to serve for the next twelve months elected.

Meetings are held every Wednesday at The Marton Working Men's Institute, Marton. There is a 3½-in. gauge continuous track, and "Track Day" is the first Sunday in each month—everybody welcome.

Hon. Secretary. K. S. ENTWISTLE, 87 Manchester Road, Blackpool.

## THE MODEL ENGINEER DIARY

**April 9th and 11th.—Bletchley & District Model and Experimental Society.**—Exhibition of working and static models at the Bletchley Secondary Modern School, Bletchley Road, Bletchley, Bucks. Open from 10.30 a.m. to 9.0 p.m. each day.

**April 12th, 13th, 14th, 15th and 16th.—The Model Railway Club Exhibition,** at the Central Hall, Westminster, London, S.W.1. Open from 12 noon to 9.0 p.m. on April 12th and from 10.30 a.m. to 9.0 p.m. on succeeding days.

**April 16th, 18th, 19th, 20th, 21st, 22nd and 23rd.—Stockport and District Society of Model Engineers.**—Exhibition of models at the Lads' Club, Wellington Street, Stockport. Open on Saturdays 10.0 a.m. to 9.0 p.m. Monday to Friday 6.0 p.m. to 9.0 p.m.

**May 22nd.—Forest Gate Model Power Boat and Engineering Society** Regatta at Victoria Park, Hackney, London, E.9. Starting at 11.0 a.m.

**May 28th.—Welling & District Model Engineering Society** Regatta at the Belvedere Recreation Ground. Starting at 2.30 p.m.

**May 30th.—Bournville M.Y. & P.B.C.**—Regatta at the Valley Pool, Bournville Lane, Birmingham. Starting at 11.30 a.m.

**June 11th and 12th. — Birmingham Society of Model Engineers.**—Annual National Rally of Steam Locomotives at the track at Campbell Green, 87, Horse Shoes Lane, Sheldon, Birmingham.

**June 25th and 26th.—The West Riding Small Locomotive Society.**—Rally of Model Locomotives, Gauges 2½ in. to 7¼ in. at Blackgates House, Bradford House, Tingley, Wakefield. Open from 10 a.m. to 10 p.m., both days.

**August 17th, 18th, 19th, 20th, 22nd, 24th, 25th, 26th and 27th.—The Model Engineer Exhibition,** in the New Horticultural Hall, Greycoat Street, Westminster S.W.1. Open from 11 a.m. to 9.0 p.m.

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THE MODEL ENGINEER

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# CLASSIFIED ADVERTISEMENTS



## WORKSHOP EQUIPMENT

**Buck & Ryan for Lathes and Accessories,** drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

**Immediate Delivery from Stock.** Myford "M.L.7" and "Super 7" lathes, Grayson, Super Adept lathes, bench planer, shapers, electric motors, small tools.—F. W. KUBACH, 12, Sylvan Road, London, S.E.19. LIV 3311/12.

**Whiston for Nuts, Bolts, etc.,** rivets, 1/32" dia. up, plastic belt, silver solder, silver-steel, screwed rod, ball-races, etc., Send for 1,000 items list.—K. R. WHISTON, (Dept. M.E.S.), New Mills, Stockport

**"Acorntools" and "Acorntools" De Luxe** 5" s.s. and s c. lathe, also "Acorntools" 7" stroke high-speed shapers and ½" capacity capstan lathes can be supplied *ex*-stock. Hire purchase terms available. Send for literature and all details to the manufacturers of these machines.—THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, Chiswick, W.4. Tel.: 3416-7-8-9.

**Overseas Orders Speciality.** New bargains reserved for post orders only: B.A. 0-6 socket spanner set, 6s. 3d.; drill chucks, No. 1 M.T., ¼", 11s. 6d.; ⅜", 13s. 9d.; ½", 16s. 6d.; lathe centres No. 1 M.T., 4s. 2d.; No. 2, 5s. 3d.; No. 3, 7s. 9d.; drill grinding jigs, ⅛", 26s. 5d.; ¼" to 1" dia. drills, 73s. 9d.; Moore & Wright, micrometers ratchet locknuts 0-1", 73s., 1"-2", 64s., 2"-3", 70s.; Universal surface gauge, 44s. 4d.; new type 12" spindle, 16s.; drill stands, 1-60, 1/10"-½", A-Z, 3s. 9d. each; spring dividers 5", 5s.; spring inside calipers 6", 5s.; dies ⅛" dia. 40 t.p.i., 5/32", 3/16", 7/32", ¼", each 2s. 9d.; taps 40 t.p.i., 5/32", 3/16", 7/32", ¼", 1s. 10d. each. Precision drill chucks, No. 1 M.T., 43s. 6d., No. 2, 44s.; independent chuck 4", 60s.; steel dieholder ⅛", 3s. 3d., 1-1/16", 11s.; micrometer 0-1", 10s. All best makes above, post free. Drills H.S. set 1-80, 100s. —S. GRIMSHAW, 7, Hall Street, Manchester 18.

**Take a Tip!** It may be "Wimet" Grind with "Diadisc" from Millett! 1¼" diamond lap, ¼" taper bore, 25s. 9d.—W. J. MILLETT, C.M.B.H.I., St. Ives, Huntingdon.

**Rebuilt Lathes.** The Acorn Machine Tool Co. (1936) Ltd. offer rebuild to limits "Acorntools" and "Atlas" 10" swing s.s. available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416).

**Shaper Pedestal** type 6" bellow make, £35.—46, Mashiters Walk, Romford, Essex. Romford 9624.

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**Wanted.** Atlas, Halifax, Sphere or similar lathes. Please state condition and list equipment.—Box No. 7666, MODEL ENGINEER Offices.

**Holbrook 4" B.G.S.C.,** with treadle and built on countershaft, on maker's stand, good order, chucks, steadies and all change wheels, £30 f.o.r. Denbigh horizontal miller, floor model; table 20" × 6" auto long feed, one inch arbor and countershaft for three speed flat belt, £30 f.o.r. Would offer both the above in part payment for new Centec Universal with various attachments.—HARRISON, Pool Cottage, Randwick, Glos.



**Myford M.L.7,** 1/3 h.p. motor, a.c., 230/250, with chucks, tools, drills, etc., plus standard equipment, very little used, £50 o.n o.—B. ARNOLD, 6, Abels Road, Halstead, Essex.

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**Flexispeed 1⅝"** backgeared lathe, countershaft, etc., £6. 2⅜" by 7" geared bench lathe compound slide-rest, auto-feed, s.c. chuck, £8. Addressed envelope full particulars.—Box No. 7675, MODEL ENGINEER Offices.

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**South Bend Workshop Lathe.** Power movement all ways 4½" × 34" between centres. Norton gearbox, excellent condition Also Atlas lathe. S.A.E. full details.—SPOTTISWOODE, 6, Bracondale, Norwich.

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**Wanted. 1¾" Lane Lathe,** with or without accessories. Please give particulars, condition, price to—TURNER, 13, Ilford Avenue, Wallasey, Ches.

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**Sale. 6" No. 2 "Super Adept"** hand shaper complete with machine vice as new, £10 10s. Apply—HARRY HORNE, 206, Burnley Road, Waterfoot, Lancs.

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**R.B. Drummond,** £16; 2½" × 11" H.T.H., B.G.S.C., £11; two incomplete lathes £2 each; lathe spares; "Model Engineers," list available.—HARDING, 643, Rochester Way, S.E.9. (ELT 7950).

**M.L.7, Motor,** Grip-Tru 3-jaw, 6" 4-jaw, compound vertical-slide, Jacobs chuck and other equipment. Owner going abroad. Offers.—COOPER, 2, St. John's Terrace, Tachbrook Street, Leamington Spa.

## MODELS AND FITTINGS

**5" "Maid of Kent"** excellent performer run only few times, £125. M.L.7 lathe, motorised on cabinet stand complete, chucks, tools, etc., £45. Would exchange both for 7¼" locomotive unfinished job might suit if workmanship good.—Box No. 7655, MODEL ENGINEER Offices.

**Steam Valves** for injectors 4s. 6d. each. Injectors, 25s. each. Condition as new, suit 3½"-g. or 5"-g.—J. TAYLOR, 10, Bainton Grove Woodmansey, Nr. Beverley, E. Yorks.

**Green Arrow 3½",** 3-cyl., £75. Also Caledonian Ry. Dunalistair No. 3, ¾" scale, £40, near offer to clear, buyer collects. After 6, or weekends.—ACO 2185, 20, Newburgh Road, Acton, W.3.

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**Wanted "Stuart" Dynamo** "Star" engine lighting set. Direct coupled on bedplate in good condition.—Box No. 7678, MODEL ENGINEER Offices.

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**Power Clock Motor,** 5" spring. Goes for 20 min. useful for working model or revolving table for display. Perfect order, 45s.—R. B. GADSDON, 126, Ramsgate Road, Broadstairs, Kent.

**Sale. Handsome 3½" Gauge Tank Locomotive** 0-6-0, £50. Two "O" gauge coal-fired boilers, £2. "O" gauge "Mollyette," £8.—FURLONG, 53, Goodwood Ave., Enfield.

**Exchange.** 3½" 4-6-0 locomotive-tender, for 5" locomotive. Repairs not objected.—LOCKLEY, 1, Hilton Street, Springfields, Wolverhampton.

**Wanted.** 1½" or 2" scale traction engine, coal-fire, any make.—MATTHEWS, 15, Banstead Road, Catcham, Surrey.

**Water-cooled Stationary Engines.** Hartop 1.h.p., £5 10s., J.A.P. twin practically unused, £8 10s. Both with magneto and carburettor. Wanted, motoring publications before 1920.—BLAND, 27, Southfields Road, London, S.W.18.

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## SITUATION

*The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged* 18-64 *inclusive or a woman aged* 18-59 *inclusive unless he or she or the employment, is excepted from the provisions of the Notification of Vacancies Order,* 1952.

**Research Assistant (Male) Required** for research on the reactions of fish to water at different temperatures. Work (in London) includes development, operation and maintenance of electrical and photographic recording apparatus. Degree in mathematics or science preferred; practical knowledge of electricity required. Salary of assistant experimental officer starting, according age and qualifications, between £290 and £520; pension scheme. Applications with particulars education, qualifications, National Service, experience, and addresses of two referees to the Director, Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Westmorland, by May 15th.

## GENERAL

**"Spraying Handbook"** 1950 ed. Car, caravan, industrial, domestic stoving, flock leather spraying, 3s. 6d. post free.—LEONARD BROOKS, 25, Harold Wood, Romford.

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**Guaranteed!** Easy home constructed refrigeration. Genuine domestic components. Not second-hand ice cream scrap. Modern hermetic G.E.C. units. Gas, electric and oil silent units. Everything for refrigeration. Complete specialists. Send s.a.e. for free illustrated "Sealed-System" leaflet or 1s. for complete catalogue (refunded with first order).—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Phone: Wallington 9309.

**Watch and Clock Lathes,** cleaning machines, staking tools, etc. (Large illustrated catalogue, 1s. 6d. p.p. price list 1s. 1d. p.p.). Stop watch and chronograph repairs and materials for the trade. Special offer. New (slightly soiled) 2½" Burnerd 3-jaw (reversible) scroll chucks, £3 11s. 9d. post paid. (Used 6, 6½, 8 and 10 mm. lathes bought, sold and part exchanged.) Easy payment terms available.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, London, E.C.1.

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**Build Your Own Refrigerator.** All components available at reasonable prices Frigidaire, "Flowing Cold," units, £5; small single-cylinder units. Kelvinator, etc., £4; ¼ h.p. heavy duty motors, £3. Chrome cabinet fittings new, £1 set. Money back guarantee. S.A.E. for lists and schematic diagram.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Hounslow 7558.

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**"Model Engineers,"** 650, 1929-1955, 6d. each, offer for quantity or lot.—LEA, 27, Cardigan Road, Leeds, 6.



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**Wanted.** Vol. 65 of "Model Engineer" or issue 3/9/31 dealing with Westinghouse Brake by "L.B.S.C."—Box No. 7676, MODEL ENGINEER Offices.

**Model Engineers,** 1933/43 6s. volume, loose, few missing.—BREAR, Summerlea, Farnboro, Kent.

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THE MODEL ENGINEER

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